THE GEOGRAPHICAL JOURNAL

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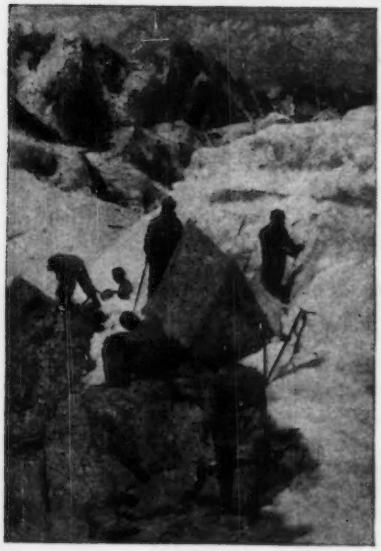

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Programme of Meetings

JANUARY—MARCH 1956

CHRISTMAS MEETINGS FOR CHILDREN

Monday January 2 *at* 2.30 *and* 5.30 *p.m.*
ZOOLOGICAL EXPEDITION TO BRITISH GUIANA. *By David Attenborough. A joint meeting with the Zoological Society.*

Wednesday January 4 *at* 2.30 *and* 5.30 *p.m.*
ASCENT OF KANGCHENJUNGA. *By John Jackson.*
Admission to Children's Meetings by special ticket only.

EXHIBITION

In conjunction with Mr. Attenborough's lecture, and with the cooperation of the Zoological Society, an exhibition will be held in the Society's Exhibition Galleries of zoological photographs and specimens, on the theme of "Geographical distribution of animals."

Tuesday January 3 *at* 3 *p.m.*
SOME MEDICAL ASPECTS OF GEOGRAPHY. *By Professor A. L. Banks. Joint meeting with the Institute of British Geographers and Geographical Association.*

Monday January 9 *at* 8.30 *p.m.*
SOME MINOR BATTLEFIELDS OF ALEXANDER IN ASIA MINOR *By Freya Stark.*

Monday January 16 *at* 5.30 *p.m.*
THAILAND JOURNEY. *Colour films with commentary by Major W. T. Blake.*

Monday January 30 *at* 8.30 *p.m.*
EAST AFRICA'S ANCIENT PAST. *By Professor Sir Mortimer Wheeler. The Mrs. Will Gordon Lecture for* 1956.

Monday February 6 *at* 5 *p.m.*
AN EAST COAST SURVEY. *By W. W. Williams.*

Monday February 13 *at* 5.30 *p.m.*
SHORES OF THE MEDITERRANEAN. *Colour films with commentary by Frank R. Newens.*

Monday February 20 *at* 8.30 *p.m.*
THE CHANGING CLIMATE OF NORTHERN EUROPE. *By Dr. D. J. Crisp.*

Monday March 5 *at* 6 *p.m.* (Please note time.)
SOUTH. *The original film of Shackleton's Imperal Trans-Antarctic Expedition.*

Monday March 19 *at* 8.30 *p.m.*
PROBLEMS OF DEVELOPMENT IN NEW GUINEA. *By Professor O. H. K. Spate.*

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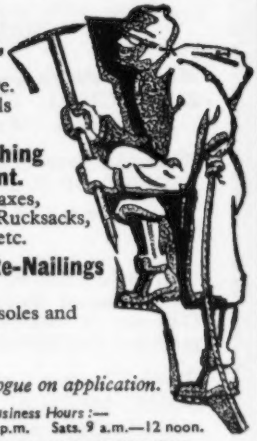

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Vol CXXI Part 4 *December 1955*

THE FALKLAND ISLANDS AND THEIR DEPENDENCIES

SIR MILES CLIFFORD

I AM GOING TO talk tonight about one of the remotest and least known of our overseas communities, the Falkland Islands, and while I imagine it is the Antarctic problem of my late parish that is likely to be of greater interest to you, I must dwell first on the history of the Falklands themselves for it is from their early history that our present controversy with Argentina stems.

The Islands, which lie between lat. 51° and 53° S. and long. 57° and 62° W.—that is to say about 400 miles east and somewhat north of Cape Horn—are said to have first been sighted by John Davis in his ship the *Desire* in 1592, an event which has been happily commemorated in the Colony's coat of arms; they were next reported by Sir Richard Hawkins in 1594 who named them "Hawkins' Maiden Land" in honour of Queen Elizabeth I; and they were reported again by a Dutchman, Sebald van der Werdt, in 1600 as a result of which they were identified for many years on charts of that period as the Sebaldine Islands—it is almost certain, however, that he saw only the Jasons, a chain of small islands lying out to the north-west. In 1690, Captain Strong of the Royal Navy sailed down between the two main islands and named them after Lucius Carey, Lord Falkland, then Treasurer of the Navy. There is no doubt that they had been frequently sighted by French merchantmen plying from St. Malo to the River Plate who called them "les Îles Malouines," hence the river Plate variant of "las Islas Malvinass," by which term they are known throughout Latin America today.

Recorded history begins, romantically enough, with de Bougainville, a young geographer and navigator employed at the French Embassy in London. After the fall of Quebec he was seized with the patriotic notion of finding some new colony for France and in 1763 he set out from St. Malo with a party of Acadian emigrants. Putting in at Montevideo, he took on supplies and livestock and arrived in what is now known as Berkeley Sound on the East Falkland in the following February; here he established his people ashore and named the settlement Fort Louis. In this same year Commander John Byron, R.N., was commissioning H.M. ships *Dolphin* and *Tamar* for a voyage of discovery and his sailing orders directed him to find and report fully on Pepys Island—which did not in fact exist—and the Falklands. He made his landfall at the latter in January 1765 and put in for shelter at one of the northernmost of the group, Saunders Island, of which he wrote in high praise to Their Lordships: ". . . the whole Navy of England," he said, "might ride here in perfect safety from all winds." He named his anchorage Port Egmont, after the

then First Lord, and took possession of the whole group of islands under their present title for King George III.

On the receipt of Byron's report Their Lordships at once despatched Captain John Macbride to carry out a detailed survey of this new possession; making for Port Egmont, where he erected a block-house ashore, he spent the whole of that year surveying the coasts in complete ignorance of the fact that there was another party of empire builders around the corner. On 4 December 1766 he was sailing peacefully up Berkeley Sound when to his utter amazement he came upon the Malouine settlement—to its Governor, M. de Nerville, he addressed a brusquely worded note and so initiated the long sequence of protests which has persisted in one form or another to this day.

M. de Nerville rebutted the Englishman's claim with equal heat but little knew that French pretensions had even then been brought to nothing. For news of de Bougainville's venture had reached the Court of Spain and under the Treaty of Tordesillas, drawn up by Pope Alexander VI in 1494 to put an end to rivalry on the high seas between Portugal and Spain, the area in which the islands lay fell in the Spanish zone; so after diplomatic representations poor M. de Bougainville had to give up his promising venture and execute a deed of cession. When he returned later to the Falklands to wind things up most of the settlers elected to go back to France with him.

The authorities appointed from the Spanish Court to take over the settlement from M. de Nerville were utterly depressed at the prospect which confronted them, at the cold and damp, the lack of trees, the incessant winds and the wild, inhospitable coast. Characteristically they renamed the islands "las Islas Nuestra Señora de la Soledad"—the Islands of Our Lady of Solitude—and stood watching the departing transport with tears in their eyes. The unhappy commander of the garrison wrote to the Spanish Governor at Buenos Aires: "If your Excellency is good enough, as we hope, to send us frequent stores we may be able to live; if not, I think that when we have consumed what we have brought with us we shall soon find an end of our labours by departing this world."

For a while the two settlements—the British at Port Egmont and the Spanish at Port Louis—politely ignored each other's existence, but in 1770, after an increasingly vehement series of protests between the parties, a force of five Spanish frigates carrying some 1600 men and a train of artillery stood in to Port Egmont which was then held by two Lieutenants of Marines and 21 men and with them a brace of Naval Captains, one of whom, Farmer, had recently been shipwrecked off Patagonia; as Senior Officer he put up a brave defiance, but in the face of such overwhelming odds there was clearly nothing to be done but capitulate and withdraw which he was permitted to do with full honours. As soon as this news reached England it created a tremendous stir and brought the two countries almost to the brink of war, but Spain, in time, professed that her local representative had exceeded his authority and undertook to restore Port Egmont to Great Britain "without prejudice, however, as to the prior right of Sovereignty over the Malouine Islands;" a rider which was to be quoted at us again and again in the years to come. One amusing aspect of this dispute was that the great Samuel Johnson was engaged by the Government of the day to pamphleteer against the war-mongers and his description of the islands was quite devastating; this is what he said of them: ". . . a bleak and gloomy solitude, an island thrown aside from human use, stormy in winter and barren in summer; an island which not the southern savages have dignified with habitation; where a garrison must be kept in a state that contem-

plates with envy the exiles of Siberia." In September of the following year the British settlement was formally re-established, only to be abandoned on Treasury pressure and general lack of interest in 1774 when the field was left once more to Spain. The Spanish maintained their settlement at Fort Louis, renamed Soledad, until the defection of the South American Colonies and the departure of the last Spanish Imperial Governor in 1806. The Islands appear to have been left then to their own devices and became a free hunting ground for whalers and sealers.

Although the United Provinces of Rio de la Plata, the rebel state, had declared themselves as successors to the legal rights of Imperial Spain and had laid claim to the Falklands, they did nothing at all about it until 1820 when they sent an emissary down; nothing further transpired until six years later when Louis Vernet, a Frenchman born in Hamburg and then resident in Buenos Aires as a naturalized Argentine subject, obtained a concession to develop the Islands and there seems little doubt that he would have made quite a success of this venture, but three years later he involved his Government in difficulties with the U.S.A. by seizing three American sealing vessels. In one of these ships he set off for Buenos Aires to pursue the matter in the Courts and, while he was there arguing, a United States corvette, the *Lexington*, slipped quietly down to the Falklands where her commander, Silas Duncan, laid waste the settlement and proclaimed the Islands free of all governance. A year later Great Britain, who had never renounced her title to the Islands, restated it and on 21 July 1833, H.M.S. *Clio*, flying the flag of Captain Onslow, appeared suddenly in Berkeley Sound, evicted the Spanish commander and his garrison and raised the British flag ashore. It has flown there—or, rather, at Stanley, to which the seat of government was shortly removed—ever since and one hopes that it will do so indefinitely for, especially in these days of nuclear threat, the Islands' strategic value and importance are obviously greater than ever.

Argentina, however, has never ceased to reiterate her claim or to accuse us of "strong-arming" her out of her possession. Her argument is based on her alleged succession to the rights conferred on Spain by the Treaty of Tordesillas, on her successful eviction of the British interloper in 1770, on the rider to the agreement to restore Port Egmont and on the alleged existence of a secret State document in which Lord North, for Britain, admitted the validity of the Spanish claim. They will not take the issue to the International Court, as we have offered to do, because they know very well that they would lose; the one issue which would count before such a tribunal is continuity of administration, and we have administered the Falklands without interruption for 120 years. A plebiscite would be equally vain for the islanders are extremely loyal and we are thus on very strong ground. It is a tiresome situation, none the less, for the Falkland Islander visiting the Argentine is liable to have his passport confiscated and to be subjected to other annoyances and indignities; and it makes for general bad feeling with one's natural neighbour.

I will touch now, very briefly, on the Colony's economy and its administration. In the early years it subsisted on exploitation of cattle, descendants of de Bougainville's herds, which had run loose when the settlers left and had multiplied enormously; they had grown exceedingly wild and the difficult work of hunting them was carried out by *gauchos* brought over from the mainland. It is interesting to note that the Spanish names for the different varieties of horse and all the different items of horse-gear still survive. In about 1835, sheep were imported by the Whittington brothers and these now represent the Colony's sole means of livelihood. In 1851 a Royal Charter was given to the Falkland Islands Company which had been formed in London and had acquired a very large tract of land from Samuel Lafone,

wealthy river Plate trader; this company has played a leading part in the Colony's commercial development and occupies a position of great strength there. Its large farming interests apart, it is the principal store-keeper and the only shipper. It collects and markets the wool for the other farms and supplies most of them with their needs. The whole Colony is now divided up into sheep farms varying in size from a couple of thousand acres to the Company's vast Lafonia farm of more than 300,000 acres; practically all the land is held in freehold. The pastures are poor and uninviting, carrying on the average one sheep to four-and-a-half acres; paddocks are of immense size and flocks tend to be too large for efficient shepherding, averaging one shepherd to about 4000–5000 head. There is much to be done and much which can be done to improve the land and lack of money can no longer be counted as the reason for not doing it for the Islands are, at present, very prosperous; the real obstacle is the shortage of labour on the farms and the difficulty of attracting immigrants to a country which has so little to offer. Indeed, an opposite trend has been in evidence for some years and there has been a small but steady drift away from the Islands to Australia and New Zealand while some gravitate to England, which to most of the islanders is "home." It is a serious problem and one that needs to be tackled purposefully for, as I took leave to say once to the Sheep Owners' Association, unless the geneticists get busy and breed a new type of sheep that will nibble off its own fleece and carry it up to the wool shed, some of the farmers are likely to be in trouble before long. The Falkland Islands Company is setting a sensible lead with the importation of selected German labour which represents, in my view, the only practical solution to this problem. That solved, the Colony's future is bright enough so long, but only so long, as the wool market remains firm; but it is never a good position to be dependent wholly on one product and especially so when that one product is threatened with increasing competition from the industrial chemist in the form of synthetic fibres. For that reason I welcomed—and did much to encourage—the establishment by the Colonial Development Corporation of a freezing factory to provide meat for the English market but I have learned recently, with keen regret, that the factory itself has been put into cold storage. It would have given the Colony another leg to stand on for never, so far as one can see, is the supply of meat likely to equal the demand and even the industrial chemist cannot produce a substitute for a mutton chop.

As to the administration I found the Falklands when I arrived there at the end of 1946 in poor shape, financially, and very much of a Cinderella colony. There was no form of political representation, no social security, and no communications; this last made life a hard and anxious burden for the people, particularly the women folk, living in isolation on the farms—in some cases, small island farms completely cut off and with nothing but a smudge fire to notify that help was required. This situation was dealt with by the purchase of a hardy little ex-naval motor fishing vessel able to put to sea in almost any weather and adapted as a miniature ambulance ship; and that was followed, a year later, by the inauguration of an internal air service and by the installation on all farms and outlying islands of a two-way radio telephone system which keeps the settlements in daily touch with headquarters and more particularly of course with the doctors, who in cases of simple illness can often prescribe over the R/T, for each farm is also supplied with a standard medical chest. The sets were furnished with two frequencies, one for routine communications with headquarters and the other for inter-farm gossip with which the welkin rings to the delight of one and all. Everybody listens in. It

is not too much to claim that these two measures have, together, revolutionized conditions in the Islands; they have saved life and spared much anxiety.

In the matter of social security the first step was the introduction of non-contributory family allowances followed by a sliding-scale cost of living allowance and the programme was concluded in 1952 with the adoption of a contributory Old Age Pension scheme for all males in the Colony; this will be a great boon, for very few of the farms provided pensions for their workers and indeed only a limited number of Government employees were pensionable.

On the medical side a new and up-to-date hospital, named after Sir Winston Churchill, replaced the earlier, obsolete institution which in turn has been reconstructed and adapted as a Tuberculosis Sanatorium, and a T.B. survey was carried out in the course of which 94 per cent. of the population was screened; this was an unique achievement and there is reason to believe that this disease, the incidence of which was relatively high, will be eradicated in the course of a few years. A travelling dentist was also appointed and this has proved most beneficial, especially to the children on the more inaccessible farms. Amenities at Stanley were improved by the installation of an efficient electric light and power supply and with the construction of a new Town Hall complete with cinema, dance hall, public library and reading room.

In the absence of facilities for secondary education an arrangement was made with the Dorset County authority which very generously agreed to accept scholarship children from the Colony into its boarding schools; the Government, of course, bearing the expense. Education on the farms was dependent very largely on travelling teachers with inevitably long intervals between visits so the Government, in partnership with the Falkland Islands Company, is experimenting in the running of a boarding school on the East Falkland which, if successful, can be repeated on the West Falkland.

On the political side a new constitution was enacted which introduced popular representation and, in its final form, secured to the people an unofficial majority; the Colony's finances are now controlled by a Standing Committee of unofficial representatives. An autonomous Town Council for Stanley was also set up. Finally, the Colony's financial situation was greatly improved and when I left last year the revenue had more than doubled since 1946 and the reserves had trebled.

Let us turn now to the Antarctic scene and to the problems which it poses for Her Majesty's Government and for the local administration. And here again I must trouble you with a little history. While the existence of a far, southern land had long been a matter for conjecture—maps of this period were invariably marked with a hypothetical land mass at the bottom bearing the legend TERRA AUSTRALIS INCOGNITA—it was not until the eighteenth century that we began to know anything at all about it and for that we have one man to thank, Captain James Cook, the navigator, who in 1774/75 sailed round the world. He won as far south as the ice would let him and dismissed the possibility of anything other than impenetrable ice beyond; there might be land, he implied, he wouldn't say there wasn't, but quite certainly no man would be able to approach it or set foot upon it—it was not, in fact, worth further search. In the course of that voyage he landed on South Georgia and claimed it for the Crown and his reports of the vast animal wealth in these waters, the countless whales and seals, was to confound his own confident prediction about the southern continent; commercial enterprise was to prove what the navigator had rejected. For his reports brought British, American

and Scandinavian whalers and sealers scurrying down to reap the rich harvest which he had painted for them and they pressed ever further south, so that first one group of islands was discovered and roughly charted, and then another. Some of the shipowners, too, particularly the Enderby brothers, were interested in discovery for its own sake and actively encouraged their captains; it is to these hardy adventurers that we owe the gradual unveiling of the southern scene until, in 1820, the Antarctic continent itself was sighted by Smith and Bransfield. This momentous discovery, as you can suppose, excited the greatest interest and it inspired a succession of voyages of exploration during the first half of the nineteenth century—

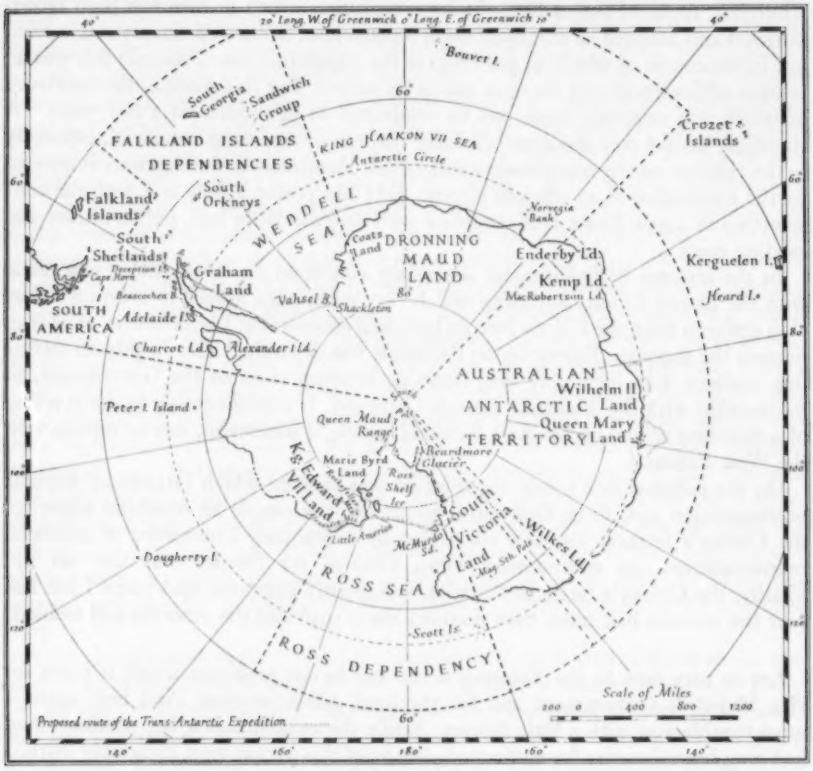


Figure 1

Bellingshausen of Russia, Dumont d'Urville of France, Charles Wilkes of America and last, and greatest of them all, Sir James Clark Ross who, in the course of three voyages with the *Erebus* and *Terror*, circumnavigated the south polar continent in high latitude and did more than any man of his day to throw light on the long hidden mysteries of Antarctica.

Having practically exterminated the southern fur seal, economic interest in the area began to wane and so too did scientific interest until it was powerfully revived by the 6th International Geographical Congress which met in London in 1895 and declared that Antarctic discovery was the most important geographical task still to be undertaken. Ambition was fired once more and a succession of expeditions set

off for the south from then on until the First World War. To name the more important, there was the Belgian, de Gerlache in the *Belgica* in 1897, the Swede, Otto Nordenskjold in the *Antarctic* in 1901—his was a fantastic story of which I wish that I had time to tell you; Dr. Bruce of the Scottish Antarctic Expedition in the *Scotia* in 1902; the two French expeditions of Dr. Charcot in 1903 and 1908 in the *Français* and the *Pourquoi Pas?*; the German expedition of Filchner in the *Deutschland* in 1910; and Shackleton's ill-fated expedition in the *Endurance* in 1915. Of the ships I have just mentioned, the *Antarctic* and the *Endurance* were crushed and foundered in the pack ice while the *Belgica* and the *Deutschland* were both beset and, drifting with the "pack" for many months, were lucky to escape destruction. Of the *Endurance* expedition, you will doubtless recall that when his ship had sunk Shackleton managed to get his people off on to the ice with three small open boats and, by dragging them when he must and using open leads when he could, he finally managed to get his party to Elephant Island in the South Shetland group and then set off in one of these ship's boats over 800 miles of tempestuous sea to South Georgia to get help. This was not forthcoming for some months, what time the survivors lived under the remaining two boats, upturned to make a hut, in a state of the most abject discomfort but always with the conviction that "The Boss," as he was known, would turn up and take them to safety which, in due season, he did without a man lost. As a leader, Shackleton was unmatched in the whole of Antarctic history and I was very glad to be able to turn the room which he occupied at Government House at Stanley into a headquarters office for the Falkland Islands Dependencies Survey; there his portrait hangs, as it hangs also in the expedition mess of the good ship *John Biscoe*, as an abiding inspiration to those who serve in the south. He died at South Georgia and is buried there with his memory still revered by the whaling men, who remember his epic boat journey and love to talk of his dramatic arrival at its end. A very active survivor of the *Endurance* expedition, Mr. James Wordie, is with us this evening.

The only antarctic achievements of note between the wars were Lincoln Ellsworth's remarkable trans-antarctic flight from Dundee Island off the Trinity Peninsula to Little America on the Ross Sea and the British Graham Land Expedition led by John Rymill in 1934–5, which was in the old heroic tradition and had as its major achievement the discovery of King George VI Sound between Graham Land and Alexander I Land. This was a high achievement and the Falkland Islands Dependencies Survey, or FIDS as it is invariably called, can be regarded as in all respects its lineal descendant and has benefited immensely by the lessons learned by Rymill and his colleagues.

The Second World War put a stop to all these exercises and it was whilst we were busily engaged with the late Mr. Hitler that Argentina and Chile, who had kept pretty quiet all these years, suddenly bobbed up. It is true that Argentina had laid claim to the South Orkneys on the ground which I mentioned just now and although a "dusty answer" was returned to this no attempt was made to dislodge her. In 1927 she followed it up with a quite farcical claim to South Georgia which was not pursued. Now that our attention was distracted Chile, in 1940, decided to take a hand and enacted an official decree claiming for herself all territory between long. 53° and 90° W. This was too much for Argentina who came back smartly, in 1942, with an Act of Possession deposited on Deception Island laying claim to practically the whole of the Falkland Islands Dependencies and overlapping Chile! So you see, one has a pretty confused picture in these parts, still further complicated by the recent theory—claimed by both Argentina and Chile, each in its own behalf

—that a nation has right of possession over the natural extension of its continental shelf. It has been maintained that the Falklands, South Georgia and the South Sandwich Islands, the South Orkneys, the South Shetlands and Graham Land itself are but a prolongation of the Andean chain, but how, in that event, Argentina and Chile are to decide whose is which is quite beyond me. To all of this we added our own touch of comedy, for the Royal Letters Patent which accredited these lands to the Crown in 1908 inadvertently included a large slice of Argentine Patagonia and it was quite some time before anyone discovered it.

The Argentine action at Deception evoked a swift reaction and H.M.S. *Carnarvon Castle* was sent down hurriedly to erase the national emblems and other ruderies which the Argentines had been so happily engaged in painting on the British huts and installations, and in 1944/5 a British Naval expedition, under the code name of "Operation Tabarin," established bases at Deception Island and at Port Lockroy, in the following season at Hope Bay and Laurie Island and thereafter at Marguerite Bay. This expedition was managed from home by a committee of scientists, but it was an impossible task for them to direct the day-to-day activities of a number of small parties from 8000 miles away. I therefore suggested that the responsibility for this organization might be transferred to the Governor, which was readily conceded, and in the ensuing years it was possible to put it on a well-ordered basis with its own ship and an efficient headquarter staff; of equal importance, it was possible to secure continuity of scientific work and to give some sort of priority to activities which would be of direct benefit to the whaling community, who contribute very handsomely to the cost of this undertaking which is, after all, of imperial rather than of local interest. Special attention was given, therefore, to building up an effective meteorological service and to hydrographic survey; two of the bases, Hope Bay and Marguerite Bay, had access to the mainland and from them sledging parties have travelled many hundreds, indeed, in the aggregate, thousands of miles engaged on topographical and geological survey and have added greatly to man's knowledge of this area. Useful biological studies have also been carried out—especially concerning the elephant seal, which is of some economic importance. We have an experimental ionospheric station at Port Lockroy and have just established an important scientific station at the Argentine Islands, where a whole range of scientific investigations is being pursued, including, for example, upper wind measurement, terrestrial magnetism, cosmic ray, solar radiation and ozone measurement. A Scientific Bureau has been set up in London to collate and publish the results and findings of all these investigations in proper form—publication commenced in 1952 and the papers have been circulated to interested bodies all over the world and have been very well received.

The Falkland Islands Dependencies Survey is unique in that it is a continuing expedition with an ever-expanding programme; thus men have to be relieved at regular intervals and the bases must be replenished with food and fuel and a thousand and one items of equipment and clothing. The problems are manifold, as each base must be completely self-reliant and self-contained for, once the relief ship has paid its last visit at the end of the summer, the ice closes in and there can be no help until next season. Just picture to yourselves the housekeeping headaches alone that this presents; then there is the difficult business of recruitment. Not only must men be found who are fully competent to carry out the particular duties required of them, but they have also to be 100 per cent. fit and the right sort of chaps temperamentally. For these purposes—recruitment and the procurement of stores—those invaluable gentlemen, the Crown Agents, were appointed as rear

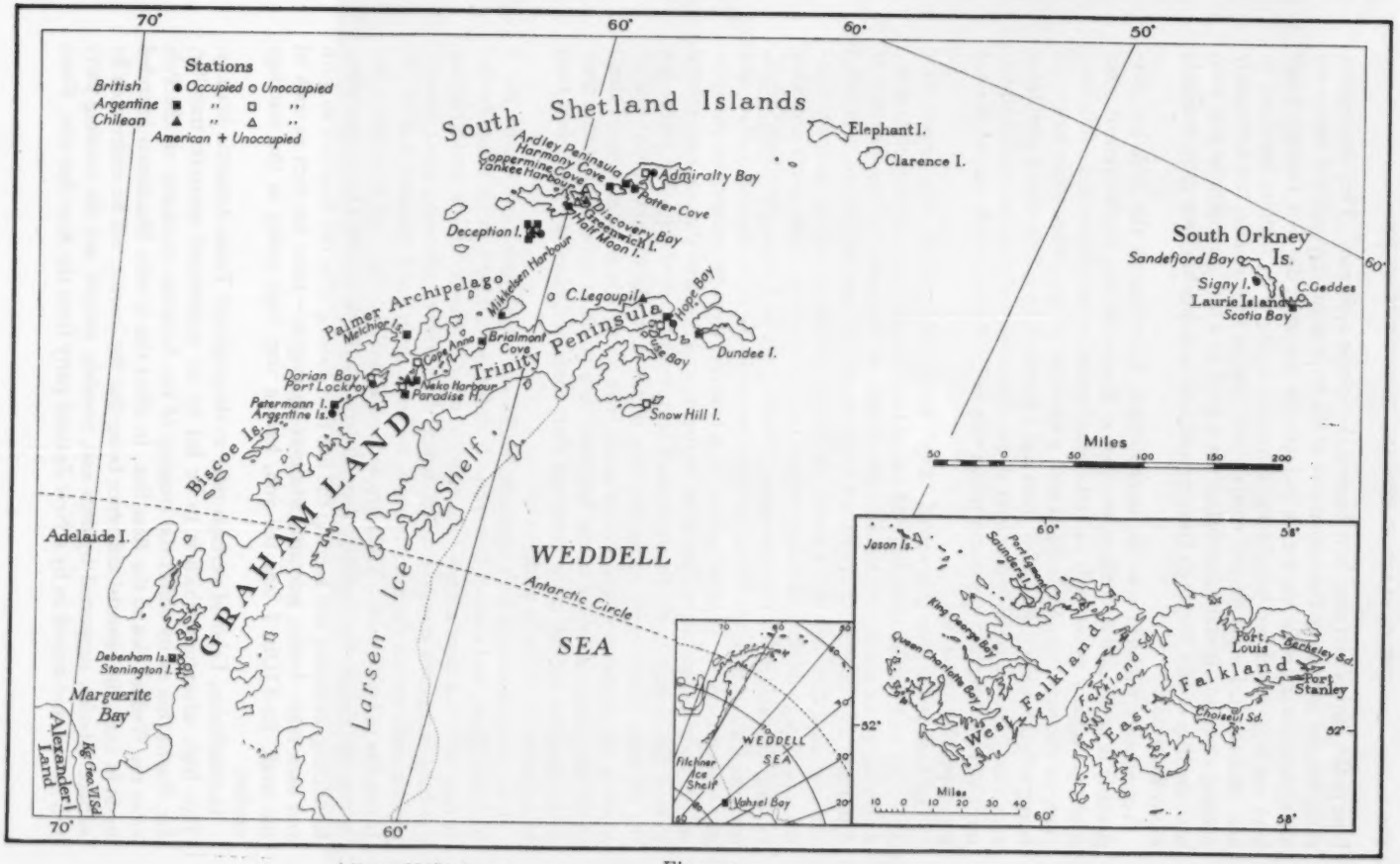

Stations
British ● Occupied ○ Unoccupied
Argentine ■ " □ "
Chilean ▲ " △ "
American + Unoccupied
South Shetland Islands
Elephant I.
Clarence I.
Ardley Peninsula
Harmony Cove
Copper mine Cove
Yankee Harbour
Admiralty Bay
Potter Cove
Discovery Bay
Greenwich I.
Half Moon I.
Deception I.
Mikkelsen Harbour
C. Legoupil
Hope Bay
Palmer Archipelago
Melchior Is.
Brialmont Cove
Cape Anna
Trinity Peninsula
Dundee I.
Dorian Bay
Port Lockroy
Neko Harbour
Paradise H.
Snow Hill I.
Petermann I.
Argentine Is.
Biscoe Is.
GRAHAM LAND
Larsen Ice Shelf
WEDDELL SEA
Antarctic Circle
Adelaide I.
Debenham Is.
Stonington I.
Marguerite Bay
Alexander I Land
Kg. Geo. VI Sd.
South Orkney Is.
Sandefjord Bay
Signy I.
C. Geddes
Laurie Island
Scotia Bay
Miles
50 0 50 100 150 200
Jason Is.
Port Egmont
Saunders I.
King George Bay
Queen Charlotte Bay
West Falkland
Falkland Sd.
East Falkland
Port Louis
Berkeley Sd.
Port Stanley
Choiseul Sd.
Miles
10 0 10 20 30 40
Fitchner Ice Shelf
Vahsel Bay
70°
60°
50°

Figure 2

base to the Survey and they have been of the utmost assistance. They are responsible, too, for overseeing the annual refit of the Expedition ship and that brings me to another of our headaches, for we had only the one ship, the *John Biscoe*, a lease-lend net layer which we bought and converted in 1947; if anything happened to her—and she had many narrow escapes—we were in bad trouble, but fortunately nothing ever did. It was nevertheless not a good or a safe arrangement and now, with the help of Her Majesty's Government, a second ship has been made available to my successor.

Yet another problem was the unpredictable behaviour of the pack ice, particularly in so far as the southernmost base at Marguerite Bay was concerned. One might get a party ashore only to find oneself unable to relieve them the following year—or the next—and we had just such a situation in 1949, when three men were facing a fourth winter and one of them had a peptic ulcer and another a grumbling appendix. We managed to get them all out and to salve all their stores and equipment and the scientific specimens which they had collected, but it was an anxious and expensive operation.

The final problem is this annual "flap" during the antarctic silly season with Argentine and Chilian intruders who are adding constantly to their encroachments, which they can readily do because they stand, so to speak, on the doorstep of Antarctica and have the unrestricted support of their armed services; where we had one ship, they had half a dozen, including transports carrying gangs of contractors' men to do their building, tankers to carry their fuel, helicopters and other aircraft to conduct ice reconnaissance. We cannot, as I have constantly urged, compete with them unless we are prepared to put in the same amount of effort, and that will cost money—a lot of money. It is true that we lodge protests on the occasion of each encroachment, but to no purpose—and it is true that we have offered to refer the dispute to the International Court, but neither of the other parties has the slightest intention of doing anything of the sort. As to how it will end or whether our friends will get tired of it all, your guess is as good as mine. I don't think they really enjoy life in the Antarctic very much, despite the fact that their living quarters are far more luxurious than ours; nor, thus far, have they been conspicuous in scientific achievement.

I am often asked if it isn't a terrible life for our young men down south? But it isn't, you know, and some of them come back for more. Doesn't time hang heavily? It does not; the days are not long enough, even in winter. It is a wonderful experience in human companionship, where forbearance, tolerance, good temper, unselfishness are not the rare virtues as we know them but a necessary way of life. It just has to be that way. There are occasional weak brothers but remarkably few in my experience. Incidentally, they all have to do their own chores, mending, laundering, sweeping and keeping the hut tidy, looking after the dogs and so forth and each man—leader, scientist, whatever he may be—takes his turn as cook of the week. Ex-FIDS, I may tell you, have a very high rating in the marriage market.

In conclusion, I should perhaps refer to the projected Trans-Antarctic journey. This high adventure which is to be led by an experienced antarctic traveller, Dr. Fuchs, has as its object the crossing of the Antarctic continent via the Pole from the Weddell Sea to the Ross Sea. In effect this is what Shackleton intended to do in 1915, the essential difference being that the journey will be undertaken by surface vehicles, supported by dogs and, possibly, aircraft and the crossing party will be met and helped in by a New Zealand party from the Ross Sea side. From

Marguerite Bay, packing up

Photo: H. Skillington

Farming country in north-east Falklands: looking west from Rincon Grande House

Government House, Stanley

the Weddell Sea, in the vicinity of Vahsel Bay, to the Pole the Expedition will be traversing completely unexplored ground and one of its main objectives will be to settle the old conundrum as to whether the Antarctic continent is in fact, as some suppose, two continents; another aim will be to measure the thickness of the ice cap right across. A variety of other scientific investigations will be carried out. The expedition has received the generous support of Her Majesty's Government, who have promised £100,000 towards the cost: it has also received the official backing of your Society, who were not only the first to give practical proof of their encouragement by a subscription of £1,000, but also have eight representatives on the Committee of Management, which has now been formally set up under Marshal of the R.A.F. Sir John Slessor to assist Dr. Fuchs in the organization. He will leave with an advance party towards the end of this year and will take out the main party in 1956, arriving at base in 1957; depot-laying and other preparatory and scientific work will be carried out and the party will start on the big journey in the spring. If all goes well they should reach McMurdo Sound in the following March. If successful, they will have written one of the most stirring chapters in Antarctic history.

DISCUSSION

Evening Meeting, 2 May 1955

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: The Falkland Islands and their Dependencies have been the subject of political controversy for a number of years, certainly for more than a century. Sir Miles Clifford, who recently retired from the Colonial Service, was for the last seven-and-a-half years of his service Governor of the Falkland Islands.

Sir Miles Clifford then read his paper

The PRESIDENT: Tonight, we have suffered a great disappointment. I had invited the Secretary-of-State, Mr. Lennox-Boyd, to come to speak to us after the lecture. Unfortunately, a few hours ago I received a message from him to say he regretted very much that his Election agent would not allow him to desert his electioneering campaign, and so he could not be with us.

Sir Miles Clifford has not told us much as to what he himself did for the Falkland Islands and their Dependencies during his seven-and-a-half years of governorship. He did a great deal for those remote members of the British Empire. We have with us my predecessor in office, Mr. James Wordie, who has visited the Falkland Islands, and I ask him to tell us something more from his knowledge of that part of the world.

Mr. J. M. WORDIE: The President has remarked that Sir Miles Clifford has told us very little about himself. You will probably wish me therefore to say something about Sir Miles. In the second year of his Governorship he began to develop many new services—educational, social and medical. He was an active Governor and achieved a very great deal in his seven-and-a-half years. In addition, during these seven years, he made no less than eleven voyages to the South, which is more than any present-day explorer has done. He is now one of the authorities on navigation in the waters of the Dependencies. I had the opportunity of seeing Sir Miles at work when he was in the Falklands. Like him I am also an admirer of Louis Antoine de Bougainville, who established the French colony. De Bougainville, who while in London appears to have been a Fellow of the Royal Society, and was also present at the battle of the Heights of Abraham, was without doubt a young man of resource and dash, not unlike Sir Walter Raleigh. His reputation, however, today may rest more on the fact that his name was given to a plant, with which many of you are no doubt familiar, the Bougainvillea.

The PRESIDENT: From what Sir Miles Clifford has told us tonight we realize that

Her Majesty's Government is placed in considerable difficulty in that outpost of the British Empire. We have with us the Deputy Director of Colonial Survey, Mr. Wiggins, and I would like him to say a little from the point of view of the survey he has carried out in that area.

Mr. W. D. C. WIGGINS: I have been concerned during the last nine years with the mapping of the Dependencies as part of the Colonial Empire. When our chief draughtsman and I visited the Scott Polar Research Institute in June 1946 at the invitation of Mr. Wordie and Dr. Roberts, we collected what material there then was, and it was a very mixed bag. There were almost as many positions and shapes for each topographical feature as there had been people in the Antarctic to sketch them, and from that material we had to produce a homogeneous map.

By about the middle of 1950 we had produced a series of maps at 1/1½ million. Though the series fulfilled many purposes it did not meet with the demands of the actual user on the ground who wanted a larger scale map on which to plot penguin rookeries, small bays and so on. So we started over again on a larger scale, mainly at 1/200,000. All the material was sorted out again, and we had been receiving an increasing volume each year from surveyors and others in the Antarctic. The accuracy of the work, on the whole, increased, but there are still discrepancies. We now invite the protagonists down to Tolworth where all the recorded evidence is displayed, and we hold their coats while they thrash out the differences! The material reaches us as the result of sledge traverses and shots from ships constituting what we surveyors call "travellers' tales."

It is easy for people to ask "Why don't you take air photographs? " but you have heard this evening of the extreme remoteness of the Falkland Islands. There are no good air bases there, and even if air crews were established there, it would be a considerable operation to mount an expedition which could take systematic air photographs. Nevertheless, we hope soon we will be able to use air photography in the region. Map-makers can produce maps from air photographs very quickly, but other users will not get as much out of air photographs of this region as in other parts of the world. Even the geologist needs to know the vegetation, and miles and miles of ice would not help anyone very much.

The PRESIDENT: I now conclude the meeting by asking you to give a most hearty vote of thanks to Sir Miles Clifford for his fascinating lecture.

EAST AFRICA AND HER NEIGHBOURS

E. B. WORTHINGTON

THE GEOGRAPHICAL DISCOVERIES of last century which led to the opening up of eastern and central Africa are approaching their centenary, so it is becoming possible to view the tremendous changes which are overtaking that part of the world in the perspective of their historical setting. In this paper [1] I am concerned with the period from about 1900 to the present day and more particularly with the last half of this period, during which I have known the countries personally. By 1900 regular communications had started their rapid development with the opening of the first section of the Kenya–Uganda Railway from Mombasa to Kisumu on Lake Victoria. Also by that date the United Kingdom had accepted responsibility for the Uganda Protectorate as well as for what is now Kenya Colony. *Pax Britannica* was becoming established, but the scientific study of the natural resources and of the indigenous human beings remained somewhat haphazard, the prerogative of comparatively few enthusiasts, until well into the 1920's. A special feature of this past twenty-five years has been the invasion of Africa by professional people, including many scientists and research workers, so that now the broad outlines both of the natural and human resources are known.

Human progress during this period has been more rapid perhaps than in any half century in any part of the world, and a factor of high importance as far as the evolution of the indigenous people is concerned is that this half century sums up the whole of their written history. Each one of the several score of native tribes comprising the East African population had of course its religion, traditions, and individual codes of behaviour before the arrival of the white man, but if we compare studies of these peoples made about 1900, 1925, and 1950, they provide contrasts nearly as marked as studies of the British say before the Norman Conquest, under the Tudors and during the Industrial Revolution of last century. This is a crude comparison for there are many individuals indigenous to East Africa who, under the influence of present-day education, have acquired twentieth century civilization to the full, although the masses remain very far behind as judged by European standards. Most people would, I think, agree that it is the hectic pace of economic, social and political change in Africa, for which the European nations are responsible, the twentyfold acceleration of history and experience, with insufficient time to gain new traditions, which is at the root of most of the difficulties of the present day.

As a means of helping to make good the lack of historical background of East Africans, and also as a contribution to world culture, much importance attaches to studies of prehistory of which so many have come from Africa in recent years. In these eastern territories, for example, L. S. B. Leakey and his colleagues have revealed much concerning the earliest evolution of the human species and our emergence from the apes of Miocene times, and he has succeeded in tracing the record through the stone ages. Another contributor noteworthy in this subject is E. J. Wayland who, after retirement from a succession of geological directorships in Africa, has returned to reveal further intricacies concerning the distribution of

[1] This paper was delivered and subsequently written for publication before the Report of the East Africa Royal Commission, 1953–5, was issued.

Stone Age man on the western side of Lake Victoria along the borders of Uganda and Tanganyika. This common background to the evolution of modern man, revealing a time when there was probably no distinction into races based on colour, may perhaps provide a cohesive influence for the future. There is, however, a very long gap between the Stone Age records and present-day Africans. Traces are abundant, but have not yet received the same attention from prehistorians.[1] When

this gap has been filled it may perhaps go some way to make good the lack of written history, on which the modern social and political pattern of nearly all other peoples of the world is so largely based.

Since the end of the First World War, British East Africa has comprised Kenya, Uganda, Tanganyika and Zanzibar. Of these the first three are very large in area, but in spite of great progress they have limited economies based on a few commodities, which are obtained mainly by tilling the soil. Mining industries, though

[1] See Fosbrooke, H., Paper to Inter-African Conference on Social Sciences, August 1955. (In the press.)

growing, have not yet attained the great importance in the general economy such as obtains in Northern Rhodesia and the Belgian Congo, the immediate neighbours to the south and west. Each territory independently had difficulty in providing all the services to the community which are necessary to a modern State, and hence from the 1920's onwards there were successive moves towards some form of closer union, at least in the economic sphere. The pooling of financial resources, such as those derived from Uganda cotton, Kenya coffee, Tanganyika sisal and Zanzibar cloves, and turning them to the advantage of all, had obvious possibilities in reducing the risks inherent in the limited economy of each political entity. In any special sphere of scientific research, moreover, East Africa as a whole could afford organizations large enough to operate efficiently, whereas each territory independently might not. The East African Governors' conference helped materially in this respect for more than twenty years until, as a culmination of many efforts, the East Africa High Commission came into being in 1948. On the last occasion on which I addressed the Society I described a number of the achievements made by the East Africa High Commission with the generous support of funds from British taxpayers, voted under the Colonial Development and Welfare Acts, in establishing a series of scientific organizations and institutes distributed at strategic points in the four territories and designed to serve all.[1]

As an indication of the total scientific effort available in these territories today compared with earlier decades, there were in the 1920's and even the 1930's, very few professional scientists; and those few, mainly agriculturalists, geologists and medical workers, had so many routine functions to absorb their time that the gaining of new knowledge of value to social and economic development was the prerogative of a handful of enthusiasts. In 1951, however, when I was asked to survey the position at the conclusion of a spell of service with the East Africa High Commission [2] there were 160 qualified scientists based on a dozen or so research institutes serving the four territories, at least as many more under the separate territorial governments and a substantial group in addition at Makerere in Uganda, the growing University College of East Africa. The development of scientific studies is of course only an index of much greater changes in other subjects; indeed the scientist in Africa is apt to follow rather than lead, because he is so often called in to solve problems after they have started to worry the administration. The new Colonial Development and Welfare arrangements which were announced recently in Parliament will, by continuing financial support after 1956, enable this scientific exploration of East Africa to carry on and in some cases perhaps to expand.

It is not only in economics and science that pooling of resources and mutual assistance has been an advantage, but also in many other branches of development. Transport is an obvious example, in that a railway system or air transport can operate with greater efficiency in large than in small units. Moreover, in questions affecting neighbouring territories or the Commonwealth, East Africa, when speaking as one, sometimes has a stronger voice than that produced by the sum of its parts. The moves towards closer association have, however, been followed during the past five years by many wishes, tending to lead in the opposite direction, expressed by the people of these territories. Closer association in East Africa is in fact tending to become less acceptable, at least to the more vocal sections of the

[1] "Geography and the Development of East Africa," *Geogr. J.* **116** (1950) 29.

[2] A survey of research and scientific services in East Africa, 1947–56. E.A. High Commission Paper No. 6 (1952), pp. 79.

population. Thus, many of the British immigrant people in Kenya, in the special and in many respects admirable civilization which they have developed, hesitate to become closely connected with other parts of East Africa which may in due course become self-governing native states. The Asiatic immigrants who fulfil so many intermediate and necessary functions in the community, and incidentally hold a good proportion of the moneybags, seem in general prepared to await developments until it is clearer which way the political wind blows. Several of the more progressive indigenous races, such as the Baganda, have no wish to become more closely connected with the immigrant peoples and are fully capable of expressing views of their own. A similar tendency towards division rather than cohesion is observable in other parts of Africa, for example in Nigeria where the outlook of different sections has already split the country into four parts, each with its separate government, remaining combined only by a rather loose federal system. Indeed, in many parts of Africa today a new or revised form of tribalism seems to be prominent, although the indigenous peoples themselves might not admit it. There can be little doubt that, if the steadying influence of European guidance were withdrawn too rapidly or too completely, differences of opinion between the many tribes would be capable of reversion to something like the old system of rivalries and perhaps even warfare. The welding together of the opposing tendencies, the economic and social need for close association between the different parts of the continent and the political desire to run one's own show, however small, however inefficient and however poor, must be one of the major problems of statesmanship in present-day Africa.

Such are among the factors of which account must be taken by geographers and all other kinds of scientists in their explorations into the natural and human resources of the continent. The object must be to develop these resources to the maximum benefit of the present generation without prejudicing the future, when the mouths to be fed, the bodies to be clothed and housed, the minds to be educated and the votes to be counted will be far more numerous than at present. The fact that most African tribes have more members than they had a generation ago and that they will be far more numerous still in the future is, of course, wholly the result of enterprise coming from outside the continent. Without such enterprise there would have been no economy in East Africa in the modern sense, nothing to spend on such social services as health and education and no political problems as we know them. Whether there would have been anything comparable to Mau Mau in Kenya is more debatable because, while stimulated by modern social and economic factors, Mau Mau is a form of atavism. In it we see the reactions to too rapid change of a disorganized society, with twice as many people as there were when they were in natural balance with their environment.

Referring to the trouble spots of present-day Africa, such as that part of the Kenya Highlands which is the traditional home of the Wakikuyu, I would suggest that the general reader may get some erroneous impressions. He hears much about the growing problems of urbanization and industrialization of Africans, for example, and admittedly these are acute locally; but, except in mining areas, they affect a very small part of the population as a whole. At least 9 out of 10 of the 18 million or so people in East Africa still live a truly rural life. They are much closer to and more dependent on the natural environment than the rural peoples of England before the enclosure of agricultural land, and few of them are interested in the conditions enjoyed or suffered by those relatively few who have been attracted to the towns or to industry. Human betterment in Africa is primarily a rural problem,

although, with the ease of modern air transport from city to city and the long time and occasional discomfort associated with travel on the ground, it is perhaps easy to gain a different impression.

The immediate geographical neighbours of East Africa are administered by the Portuguese and British to the south, Belgians to the west, Sudanese, Ethiopians and Italians to the north. But for the purpose of this paper I would extend the neighbours to include other territories as well. Those territories marked on the map comprise nearly the whole region and are responsible to six metropolitan powers, namely Belgium, France, Portugal, the Federation of Rhodesia and Nyasaland, the Union of South Africa and the United Kingdom. Mutual assistance between groups of adjacent territories responsible to the same metropolitan power has been proceeding for a long time. The first to achieve true federation were the territories which are now provinces of the Union of South Africa; then followed the five territories of Afrique Occidentale Française and the three of Afrique Equatoriale Française, with the mandates of Togo Français and the Cameroun Français loosely attached. Cohesion between the British East African territories came considerably later as already described; a degree of mutual assistance between the four territories of British West Africa was developed about the same time, whereas the latest move towards a true federal system has been between the Rhodesias and Nyasaland. The difficulties of language and the differences between the national approaches towards colonial administration, coupled with systems of communication from ports at the coast running inland in the separate countries and only rarely communicating with each other inside the continent, have greatly delayed contact between the sub-regions responsible to the different European nations.

One of the first to draw attention to the diverse and often conflicting principles which were being applied by the several European nations in solving the many common problems was General Smuts who, in his Rhodes Memorial Lecture delivered at Oxford in 1929, put forth an eloquent plea for the survey of the whole situation in Africa south of the Sahara so that each nation and territory could learn from the experience of its neighbours. This developed into the African Survey conducted by Lord Hailey and published with its companion volumes shortly before the Second World War. It was not, however, until after the War that real efforts were made by the responsible governments to compare and coordinate their activities. The process started in 1945 when the French and British initiated mutual discussion; two years later the Belgians, Portuguese, South Africans and Rhodesians joined in, with the result that C.C.T.A. (la Commission pour la Cooporation Technologique en Afrique au sud de Sahara) was created in 1950. Meanwhile the scientists working in Africa had felt the need for a system of cooperation and this was expressed at the Royal Society's Empire Scientific Conference held in London in 1946, which led three years later to the convening of an African Regional Scientific Conference by the South African Government at Johannesburg.[1] On this occasion representative scientists from nearly every country south of the Sahara reviewed the whole field and an immediate result was the establishment in 1950 of C.S.A. (le Conseil Scientifique en Afrique au sud du Sahara). The area covered by C.C.T.A. and C.S.A., and the headquarters of the various bodies described in this paper, are shown on the map on p. 418.

Having sprung from separate roots, C.C.T.A. for administrative and political

[1] Vol. I, Proceedings and Resolutions; Vol. II, Statements and Communications. Government Printer, Pretoria.

reasons, C.S.A. from the expressed wishes of scientists, but aiming at common objectives, it was obvious that the two bodies should work in the closest association from the beginning. C.S.A. became the principal scientific and technical adviser, bringing to bear experience in the many different subjects from all the sub-regions, and C.C.T.A. became the executive and financial authority. From the beginning of this year this association has become even closer with the amalgamation of the two secretariats of C.C.T.A. and C.S.A. under a common head, although maintaining two bases, one primarily for administrative purposes in London, and the other as a scientific centre at Bukavu in the Belgian Congo.

For the past five years the activity of this inter-African organization has been considerable. It has arranged many conferences, symposia and meetings of specialists; it has arranged visits and prepared publications. By restricting itself mainly to the scientific and technical fields and by avoiding controversial issues a large measure of agreement has been reached by the participants of different nations. Much of the work has been designed to overcome the isolation which many people in Africa have to suffer, and to pool available information in such a way that progress in any particular subject can be more rapid. Many of the subjects to which attention has been devoted are of interest to geographers, and indeed form part of the general subject of geography and, since the publications are somewhat scattered, it seems worth while reviewing some of the principal achievements here.

Mapping and surveying were recognized from the start as fundamental to all forms of development, so that an early work by C.S.A. was the preparation of a list of maps of Africa south of the Sahara [1] which is already out of date and will shortly be replaced by a revised edition. Then, in November 1953, a small group of specialists, consisting of the principal persons who are responsible for this subject in the African territories, met to discuss how far coordination of programmes could be arranged.[2] The subjects ranged widely, from the best figure of the earth for use in African mapping, map projections and scales, to conventional symbols and the spelling of place-names. Concerning geodesy, much appreciation was expressed of the work now completed by the Americans to fill the gap in the primary triangulation of the 30th arc of meridian, which provides the backbone of triangulation in the whole continent, and of which a portion lying in Uganda and the Anglo-Egyptian Sudan had remained incomplete for many years.

The demand for large-scale maps in the present stage of Africa's development is so urgent that suggestions were made for the quick production of many provisional editions of maps on the scale of 1/100,000 and larger, rather than the printing of relatively few sheets in final form. In order to assist the numerous specialists who have to prepare maps of particular distributions in connection with their studies, it was recommended that pulls of the black plates (uncoloured) of certain uniform series should be made available in substantial numbers as a basis on which all scientists could plot the particular distributions in which they are interested. This would lead to some degree of uniformity and the direct comparison of one distribution with another. Apart from such specialized questions, a fruitful result of this initial meeting has been the establishment by the member governments of a

[1] C.S.A. Publication No. 4. Maps of Africa South of the Sahara, 1953, pp. 122, now revised and reissued as No. 15. Maps of Africa South of the Sahara: Part I. Topographic Maps, and No. 17, Part II, Special Subject Maps, 1955.

[2] C.S.A. Publication No. 12. Mapping and Surveying of Africa South of the Sahara, 1955, pp. 22.

permanent inter-African committee on surveying and mapping, so that progress and programmes can be kept under continuous review.

Geology is another subject in which, after much discussion, the pattern of inter-African cooperation became fixed only last year. There is now an inter-African scientific correspondent in geology in the person of Dr. S. H. Haughton based at Pretoria. The Association of African Geological Surveys continues to hold periodic meetings for the discussion of problems on a continent-wide basis and, in addition, three regional groupings of the territories, for eastern, western and southern Africa, are to hold periodic meetings for more localized questions.

Climatology has also been recognized as having fundamental importance in all branches of development, and work has started on preparing a climatological atlas of Africa by coordinating information which is available for the different territories in scattered form. Finance has been provided by the member governments of C.C.T.A., and Dr. S. P. Jackson of the University of the Witwatersrand is in charge of a group of workers with a view to publication of the climatological atlas in about three years' time.

For soil science there have been two large inter-African conferences, in 1949 and 1954; an Inter-African Soils Bureau (B.I.S.) is established with headquarters in Paris and puts out periodical publications reviewing the whole field; an inter-African pedological service has been established with its base in the Belgian Congo and is helping to coordinate such questions as the mapping of soils. In addition, four Regional Soils Committees for southern, central, western and eastern Africa have been set up; that for eastern Africa, which includes specialists from neighbouring territories as well as British East Africa, held its first meeting in 1955.

In the agricultural group of subjects, other than soils, attention is being devoted to certain specialized branches such as the mechanization of agriculture, for which an inter-African conference is being held in 1955 at Kampala in Uganda. The problems of forestry also have been considered on the regional basis at a gathering of specialists from nearly every territory.

Concerning wild life a pan-African Conference was held in 1954 to review the international convention on the conservation of Africa's fauna and flora, which dates from 1933. In addition, one special problem which is fundamental to all aspects of wild life conservation and control, namely the methods of estimating wild animal populations, has been examined in detail. For this a group of specialists met in April 1954 and the meeting resulted in a report which recommends certain simple methods which might be applied with advantage in many different countries.

Concerning the troubles and difficulties occasioned in Africa by insects, each of the three species of locusts in Africa, the Desert, African Migratory and Red Locusts, has an international organization for its study and control. That for the Desert Locust is centred on Nairobi, although much of its work has to be conducted in countries well to the north, where the permanent breeding areas of this insect are mainly located.

Tsetse flies and the trypanosomiasis diseases which they transmit to domestic animals and man are the concern of the first inter-African bureau to be set up for coordinating and distributing information. This is the Permanent Bureau for Tsetse and Trypanosomiasis (B.P.I.T.T.), which is situated at Léopoldville and issues periodically summarized statements of all the work in these subjects conducted throughout the tsetse belt of Africa.

For animal health and disease a bureau of information and coordination has also been established, this being the Inter-African Bureau of Epizootic Diseases

(I.B.E.D.) under a British director, Dr. Beaton, and housed in Kenya at the headquarters of the East African Veterinary Research Organization. As a good example of how collaboration works in practice, a major outbreak of rinderpest occurred during 1954 in Uganda and the eastern part of the Belgian Congo, the disease having entered from the southern Sudan, presumably through the agency of wild animal movements. Following a small meeting between specialists in East Africa and the Congo, arrangements were made for preparing large quantities of a special vaccine with which cattle were inoculated in the path of the epizootic; thereby it has been suppressed. I.B.E.D., like the other inter-African bureaus, issues periodic bulletins and other information giving up-to-date news on the distribution and outbreaks of animal diseases and summaries of all relevant literature.

In fisheries the chief attention so far has been devoted to the great lakes and rivers, and also to the new and growing fish farming industry. For these subjects C.S.A. organized a symposium in 1952, the report of which provides a good indication of the progress in these subjects in all territories.[1] In the African seas a special interest attaches to the discovery of coelacanth fishes which were formerly thought to have been extinct for 300 million years. Eight specimens have now been obtained from the Comores Islands, and it is perhaps no coincidence that the particular part of the ocean in which these islands lie, namely the Mozambique Channel and adjacent waters, is one of the least known areas of the world. Proposals have been made for organizing an international expedition to explore the physical and biological oceanography of this area, where coelacanths are now known to have survived.

In public health and medicine mutual assistance is the concern of the African Regional Committee of the World Health Organization, as well as of C.C.T.A. Among the numerous fields of work, nutrition has been the theme of three inter-African conferences up to date and is the subject of a permanent group of correspondents drawn from the member governments in order to ensure maximum cooperation between the numerous units devoted to nutrition in the African territories.

In the social and economic sciences one is treading perhaps on ground which might become dangerous because it is difficult to avoid contrasting the political ideologies as affecting the subject races. On strictly scientific aspects, however, progress has been made, first by mutual discussion between a group of specialists called together by C.S.A. a few years ago, and now during 1955 at a large inter-African conference on the social sciences, which has been convened in the Belgian Congo. A series of conferences on rural welfare has also been arranged, and two have taken place. A permanent inter-African committee on statistics started work during 1954 following two conferences on this complex of subjects, in which comparisons between one territory and another are by no means easy on account of differences in method. In technology, housing and building studies in which much valuable experience can be gained from one's neighbours have been the subject of an inter-African conference, and once again a permanent committee has been established. Finally, a directory of scientific and technical libraries in Africa has already passed through two editions, of which the second [2] includes detailed particulars of more than 300 libraries in the countries concerned. Another directory

[1] C.S.A. Publication No. 6. Record of a symposium on African hydrobiology and inland fisheries, 1954, pp. 153.

[2] C.S.A. Publication No. 10. Directory of scientific and technical libraries in Africa south of the Sahara, 1955, pp. 71.

to all the main scientific institutes and organizations, with information about what they are doing, has been completed.[1]

So much for a condensed summary of how the new organization for inter-African mutual assistance has been working since its inception in 1950. We can claim that, apart from the tangible results which can be set down on paper and many of which have been published in a number of volumes of conference proceedings, information pamphlets, periodic journals and the like, it is creating something less tangible but more permanent—namely a general feeling of neighbourliness arising from an interest in and understanding of what is happening over the border. Personally, I have a profound faith in the ideals for which we have been working and I believe that gradually we shall see evolving an Africa which, in spite of the complexity of its political divisions and of its racial and other problems, will be able to speak on many world affairs with a common voice.

These activities, whether in East Africa itself or in the other sub-regions of the continent, are directed to the steady progress of the least developed region of the world. Whither is this rapid development leading the inhabitants? Judging from the newspapers it would seem to be to native risings and misunderstandings, for it is those episodes which catch the imagination rather than the steady, perhaps mundane, progress. Some people are apt to say that Europeans have brought little good to Africa and that the most backward people are often the happiest. But no part of the world can stand still, and there can be no satisfactory social or political development without an expanding economy. Indeed the economy must expand faster than the population, because otherwise the standard of living and the self-respect which it engenders will no longer continue to rise. We Europeans, as recent immigrants to the continent, have helped enormously to uncover the resources on which the rising economy is based; we have gone much further and have introduced systems of education, health and other social services, paid for by the proceeds of the rising economy with contributions from outside. But we can only guide, not direct, what the African peoples think, and what they will make of their ultimate destiny.

DISCUSSION

Evening Meeting, 18 April 1955

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: Dr. Worthington was Secretary-General of the International Scientific Council for Africa south of the Sahara. His was a most interesting position because he had one foot in the Belgian Congo and another in the neighbourhood of Cambridge. That international organization is a scientific research bureau which has a high standard of scientific research into all problems—economic, agricultural and so on—which affect those vital territories in Africa south of the Sahara.

Dr. Worthington then read his paper

The PRESIDENT: The Romans were the first imperial power in the Christian era to attempt to develop Africa, and they had a rather trite saying: *ex Africa semper aliquid novi*—we in this Society are grateful to Dr. Worthington for having brought us something new and red-hot out of Africa.

Following the Romans, the British Empire set out to develop Africa, somewhat sporadically in different places and largely due to individual effort; for example, David Livingstone, that great Scottish missionary and great geographer. I wish David Livingstone had been here tonight to see some of the development which has

[1] C.S.A. Publication No. 14. Directory of scientific institutes, organisations and services in Africa south of the Sahara, 1955, pp. 133.

taken place as a result of the work carried on since his day. We Britishers can feel, and the Fellows of this Society can take, a certain legitimate pride in the way in which Africa has been developed under British influence.

We are privileged to have with us as our guest Sir Hilton Poynton, Deputy Under-Secretary at the Colonial Office. In his official position he has been keeping, naturally, in very close touch with the wonderful research work which has been carried out in Africa by Dr. Worthington and his colleagues. I now ask Sir Hilton Poynton to add a few words.

Sir HILTON POYNTON: Firstly, I should like to thank you, Mr. President, for having invited me to be present tonight. Secondly, I wish to convey an apology from the Permanent Secretary, Sir Thomas Lloyd, who would like to have been present. Thirdly, I wish to thank Dr. Worthington for a fascinating lecture. I believe Dr. Worthington and I are almost exact contemporaries, within a month or two at any rate. He made his first visit to Africa in 1927, in the year in which I joined the Home Civil Service. My first experience of Africa came about six years later, when I was lent to the Government of Sierra Leone. I must say that conditions there were then extremely primitive.

Dr. Worthington has been especially concerned with East African affairs, but I would like to observe that he was for three or four years in the Colonial Office as Secretary of the Colonial Research Council. Thus he has a very general knowledge of colonial affairs, quite apart from his field work in Africa. There is no doubt that in these days of rapid economic and social development the importance of proper geographical studies and efficient maps is increasing. Dr. Worthington himself has said in the foreword to a publication on 'Mapping and surveying Africa south of the Sahara' that "Good maps are fundamental to nearly every form of scientific, economic and social development." We in the Colonial Office are greatly indebted to the Royal Geographical Society for the help given us in many aspects of our work, including the finding of geographers for special projects and producing candidates for the Colonial Service.

I would like to refer particularly to the international work with which Dr. Worthington has recently been associated, because since the last war there has been great development of community interest in Africa, as evidenced by the creation of a Special International Committee on Overseas Territories by the O.E.E.C. in Paris; also by the creation of the network of the Commission for Technical Cooperation in Africa with its offshoot, the Scientific Division, which itself has a Council of which Dr. Worthington was until recently Secretary-General.

Also I wish to pay tribute to the increasingly close unofficial contacts between the Universities at home and Universities, Colleges and Research Institutes in our colonies, where we are operating without any regard to national barriers or anything else. I had hoped, Mr. President, that the Portuguese Ambassador would have been with us this evening, but he has been called back to Lisbon and was unable therefore to come. But there is one particular example of this international cooperation which seems to me to deserve special mention, and that is the fact that the Government of Mozambique and the Government of the newly created Federation of Central Africa have recently agreed to a scheme of jointly producing all the records in their archives department and their key historical documents in book form; the early material is almost wholly of Portuguese origin and will be of the greatest possible value to students of the geographical history of Africa. That I cite as a practical and valuable instance of the cooperation which has been developed through C.C.T.A. and the Scientific Division.

The PRESIDENT: I now call on Sir Bernard Keen, whom you probably know in connection with the Agricultural Research Institute at Rothamsted where he has worked for so many years in conjunction with Sir John Russell. Sir Bernard Keen was also formerly Director of the East African Agriculture and Forestry Research Organization.

Sir BERNARD KEEN: My own particular relations and experience are, of course, confined to East Africa. While Dr. Worthington has taken us rather breathlessly around the environs of East Africa, I myself was seeing in almost everything to which he drew attention an analogy in East Africa itself. One thing which impressed me, as I am sure it impressed Dr. Worthington, was the remarkable facility of East Africa to act as a pilot scheme for almost any imaginable general African problem. There are the Masai, still practising the immemorial pastoral system of prehistory. There are examples—all too many—of overcrowded subsistence farming, leading to erosion and its consequences. Then, at the other end of the scale, there is the highly developed agricultural system of the Baganda, based on cotton and coffee, so advanced that the conception of freehold of land has been adopted—and may I say that, in my view, freehold, or some workable equivalent, is essential for an economically stable agriculture. Again, one can contrast the large-scale plantation type of agriculture with the efficient peasant system embracing a valuable cash-crop, such as the Uganda variant already mentioned. Dr. Worthington mentioned the East Africa High Commission and how in recent years there has been a tendency for the three constituent territories to go their own way. That possibly arises from the fact that there are three different systems of government—Kenya, Tanganyika and Uganda respectively. This has produced difficulties, particularly for the scientific people, because the committee and the conference habit, which is one of the blessings the British are supposed to take with them wherever they go, has become developed in a somewhat proliferous form. One of my difficulties in East Africa was to get a committee which did not have three times as many members as necessary because each of the territories must be represented; or, alternatively, three committees, one for each territory, plus a fourth committee to coordinate the other three. At times one felt as if one were under the apex of an inverted pyramid trying to do scientific work, and when the pyramid began to topple over the idea of trying to put it right was to add another layer on top, to form another committee. Whatever the final outcome, I believe the overriding problem is the double one of trying to introduce technical improvements—in agriculture as in industry—in the face of social systems still incapable of accepting them.

It is little use, for instance, going to a subsistence farmer, who has a wife and one or two children all working hard to cultivate the maximum area possible, and saying that education is so important that the farmer must spare his children for so much of the year to go to school. It is almost like going to a highly-mechanized English farm which requires the full-time use of two tractors and telling the farmer that for some reason or other he must spare one of his tractors for half the year. His farm would collapse. Actually the resistance to education or resistance to change on the part of the Africans is not so much a desire not to be dragged out of their environment as the impossibility of seeing how anything else can be done with limited family resources. It is there that our own contribution to Africa can be of the greatest value: we can supply the technical and scientific knowledge, make anthropological enquiries, and provide all the various aids which are necessary and without which the African must try to pull himself up by his own bootlaces. After some eight years' study of the progress which has been achieved in East Africa I feel reasonably hopeful that a change will take place. It will be slow in the beginning, and it is no use hurrying it beyond its own natural speed.

The PRESIDENT: Dr. Harrison Church is Lecturer in Geography at the London School of Economics, and he has cooperated with the lecturer in African affairs.

Dr. HARRISON CHURCH: My experience of Africa has been entirely on the west side and therefore I do not feel justified in commenting in detail on what Dr. Worthington has told us about East Africa. But I can say that the tendencies the lecturer has mentioned are true also of West Africa. The trend is for political ways to separate while in the technical fields there is considerable collaboration. In my view, collaboration through such a technical organization as C.S.A. is valuable not only for intrinsic

reasons but also to overcome the previous very sad ignorance of each other's work. I found in West Africa that sometimes exactly the same piece of research was being developed on cocoa on one side of the boundary as on the other side, and often the workers did not know what their neighbours were doing.

Then C.S.A. is very important in its own field of activity—for example, to geographers in the preparation of the list of maps recently produced and the conference held on African mapping. I was glad to notice in the third Annual Report of C.S.A. that geography is now fully represented in its manifold branches.

Further, C.S.A. will be very important in giving a lead to the various Colonial Offices or Ministries of Overseas Provinces of the various Powers in Africa. C.S.A. might well, for example, suggest to our own Colonial Office—and here I take advantage of the presence of Sir Hilton Poynton—the desirability of having a colonial atlas—we are still the only power without such an atlas—and also the desirability of putting more real geography into the sections described as 'Geography' in the Annual Reports of the various territories.

The PRESIDENT: I feel sure you will wish to join in hearty applause in appreciation of the lecture we have had from Dr. Worthington.

THE STATE OF SOVIET GEOGRAPHY

ACADEMICIAN A. A. GRIGORYEV

THE CONGRESS of the U.S.S.R. Geographical Society of 1955 was an important event in the scientific life of the U.S.S.R. More than one hundred scientific papers were read on physical geography, geomorphology, paleogeography, biogeography, economic geography, cartography, ethnography, history of geographical knowledge and historical geography. About 2000 delegates and guests from all parts of the U.S.S.R. came to Moscow for the Congress. Foreign geographers were represented by delegations from eleven countries (Albania, Bulgaria, China, Czechoslovakia, the German Democratic Republic, Hungary, India, Korea, Mongolia, Poland and Romania). The Congress was mainly concerned with making known the major achievements of Soviet geography in the seven years since the last congress; to reach agreement on the main theoretical problems of geography in dispute; and to define the most important tasks of future geographical research.

The most noteworthy geographical discoveries made recently by Soviet geographers have been in the central part of the Arctic Ocean and in the North-west Pacific. Arctic explorations have been conducted by a number of expeditions fitted out by the Arctic Research Institute together with other scientific institutions. The important results of these explorations were reported by V. F. Burkhanov, chief of the 1954–5 expedition, in his paper: THE LATEST GEOGRAPHICAL DISCOVERIES IN THE SOVIET ARCTIC, and by Professor Y. Y. Gakkel, who read the paper: RELIEF OF THE BED OF THE CENTRAL PART OF THE ARCTIC OCEAN. Much information emerged during the exploration of the ocean bed north of the New Siberian Islands to the North Pole and further on to the Lincoln Sea (which washes the extreme north-east of the Canadian Archipelago), and from this line in the direction of the Pacific Ocean. Explorations were started there in 1948; this year, a party of the expedition of the Arctic Institute headed by Y. Y. Gakkel, drifting on an ice floe, found at a point lat. 86° 26′ N. and long. 154° 33′ E., a depth of no more than 4332 feet, instead of the greater depths expected. Numerous soundings taken in the adjoining areas, and Y. Y. Gakkel's comparisons of various oceanographical data collected by the expedition in 1948 and by earlier expeditions, indicated that a solid underwater mountain ridge had been discovered extending along the meridian of the New Siberian Islands to the Pole and beyond it towards Lincoln Sea. Comparisons of oceanographical data available for adjoining areas and for the whole central part of the Arctic Ocean suggested that this ridge cuts across the entire central part of the ocean, dividing it into two deep isolated depressions. This conclusion was based on the predominance of cold bottom waters of Atlantic origin on the Atlantic side of the ridge and on the Atlantic character of the rich zooplankton at great depths in this part of the ocean, whereas on the Pacific side of the ridge the bottom waters are noticeably warmer, and the zooplankton is poorer and of a Pacific character.

Investigations conducted by the Arctic Institute in 1949 found a depth of 3297 feet along the extension of this ridge, named by the U.S.S.R. Academy of Sciences the "Lomonosov Ridge." Investigations organized by the Arctic Institute in 1950, under the direction of M.M. Somov, on a drifting ice floe in the central part of the Arctic Ocean on the Pacific side of the Lomonosov Ridge (i.e. north of Wrangel Island), led to the discovery of a new, lower elevation of the bed running parallel

to the above-mentioned ridge. After that, the American T3 expedition (1952–4) drifting on an ice floe found a 180-mile-long underwater range of the same extension as the Lomonosov Ridge (and also on the Pacific side of the latter) between the mainland shallow of the Canadian Archipelago and lat. 89° N. The same expedition discovered a few minor underwater ridges running parallel to the former and situated closer to the Pacific Ocean.[1] Investigations by the Soviet and by the American expeditions revealed that the relief of the bed in the central parts of the Arctic Ocean is much more complex than had been supposed. Further explorations conducted by Soviet scientific expeditions since 1954 have shown that in places the Lomonosov Ridge has steep slopes (up to 24°), that its summits are situated at a depth of about 3250 feet (the minimum depth being 3129 feet), and the saddles at a depth of 5000–5250 feet. The ridge rises about 9000 feet above the adjoining depressions of the ocean bed.

The underwater mountain elevation situated in the central part of the ocean, north of Wrangel Island, turned out to be wider than the Lomonosov Ridge. Beginning at lat. 76–81° N. and long. 180° E., it runs at first parallel to the Lomonosov Ridge. Before covering approximately half the distance to the mainland shallow of the Canadian Archipelago, it turns at an angle of about 90° towards the American Continent, apparently forming a number of parallel ranges. Along with the underwater mountainous elevations the central part of the Arctic Ocean was found to have a multitude of deep depressions between these elevations.

The new data gained from exploring the slope of the mainland shallow considerably changed our conception of its character. According to Soviet expeditions, for example, to the north of Bering Strait this shallow extends 360 miles beyond the point formerly believed to be its limit, and there forms a peninsula with slopes broken by canyons. Investigations, by analysis of radioactive content, of ground samples extracted by Soviet expeditions from the ocean bottom have shown that this ground has taken shape in the last 45,000–50,000 years. Judging by changes in the microfauna of these deposits, their stratification indicates that thrice in their lifetime colder periods (beginning with the contemporary one) have alternated with warmer periods, and that on three occasions the access of Atlantic waters to the central regions of the Arctic Ocean have been stopped, or almost stopped. Noteworthy among results of the investigations of Soviet expeditions is the discovery that the vast "ice islands" encountered among the drifting ice have an area up to 270 square miles, and that some of them, as is suggested by their structure and relief, represent formations of shelf ice. Air reconnaissance of the ice islands has made it easier to study the drift of the ice in the central part of the Arctic Ocean. It was found that on its Pacific side the drift is clockwise, whereas on the Atlantic side it moves anti-clockwise. Some of the ice moves within a closed circle, while some of it is carried outside to the Greenland Sea (on the Atlantic side), and to the Chukotka and East Siberian seas (on the Pacific side). The radius of the circuit ice drift on the Atlantic side of the Arctic Ocean is subject to great changes, depending upon many circumstances. Observations of thawing and freezing in the central part of the Arctic Ocean conducted by Soviet expeditions have shown that on the drifting ice in the areas adjoining the Canadian Archipelago the process of freezing predominates over thawing, and that the ice is gradually thickening in that region; on the other hand, in the areas adjoining the Chukotka and East Siberian seas thawing predominates over freezing, and the ice here becomes thinner. It

[1] See A. P. Crary. "Bathymetric chart of the Arctic Ocean along the route of T3, April 1952 to October 1953." *Bull. geol. Soc. Amer.* **67**, 7 (1954).

follows, that during the drift of floating ice from one part of the ocean to the other, the nature of the change in its mass produced by thawing and freezing is reversed. Thawing and freezing take place on the top as well as on the bottom surface of the ice. Observations of aquatic fauna at all levels of the central parts of the Arctic Ocean have shown that life exists throughout the depth of the ocean; at great depths plankton organisms are far more numerous than was previously believed. Deep-water fauna, the existence of which was unknown before, was found in the bottom layers of the Arctic Ocean.

Discoveries made by Soviet scientists in the Pacific Ocean in recent years were dealt with in the paper read by Dr. V. G. Kort, director of the Oceanographical Institute of the Academy of Sciences, entitled, MAJOR RESULTS OF OCEANOGRAPHICAL INVESTIGATIONS IN THE PACIFIC BASIN CONDUCTED BY THE S/S "VITYAZ" EXPEDITION. It summed up the results of the investigations conducted in the last five years in the North-west Pacific, as well as in the Bering Sea and the seas of Okhotsk and Japan, under the joint sponsorship of the Institute of Oceanography and other scientific institutions. In five years, the *Vityaz* covered 130,000 nautical miles, with more than 3000 stops to take samples and soundings, and made hydrographic observations covering a distance of 66,000 miles. The explorers are largely indebted for their success to the excellent laboratories and latest technical equipment on board the ship, which made it possible, for example, to drop anchor in places up to 6 miles deep. A number of new big underwater ridges and dozens of new underwater volcanoes were discovered in the North-west Pacific. Soundings have shown that the Hawaian underwater ridge extends in an unbroken line far to the north-west, and that beginning at the depth of about 10,000 feet it divides the northern part of the ocean into two isolated deeps. Special attention was devoted to the exploration of the deep Kurile–Kamchatka depression in the north-western extremity of the ocean. It was found to be considerably narrower than was believed, while the depth was 34,050 feet and not 27,670 feet. Depths exceeding $5\frac{1}{2}$ miles form a deep trough 3 miles wide and 310 miles long. A chain of isolated underwater mountains (volcanoes) has been found on the outer edge of the depression. In the south, this depression extends to the Japanese deep, and in the north it is separated from the Aleutian underwater depression by an elevation, its highest part forming a ridge situated on the line of extension of the Hawaian Ridge. The 110 foot long columns of bottom deposits made it possible to establish the stratigraphy of these deposits, the sedimentation of which has lasted hundreds of thousands of years. Chemical analysis has shown that the mineralization of the organic substances contained in them had taken hundreds of thousands of years, although this process becomes slower as the depth of the ocean increases. Hydrological investigations conducted by the *Vityaz* expedition had as their purpose the study of the origin and dynamics of the water masses, their thermal and chemical regime. It turned out that the structure of the waters in the Bering Sea bears a strong resemblance to the corresponding structure of the adjoining regions of the Pacific Ocean. Owing to their general hydro-chemical nature one might describe the waters of the Bering Sea and the Sea of Okhotsk as gulfs of the Pacific.

It was found that the temperature of the water in the Bering Sea was higher than during earlier investigations. Of great interest is the concentration of biogenic elements found in the Far Eastern seas; it is especially high in the Bering Sea, slightly less in the northern part of the Sea of Okhotsk, and considerably less in the Sea of Japan; moreover, in the warm Tsushima current it is less than in the colder western part of the sea. The abundance of biogenic elements, which

are the basis for the nutrition of the plankton, explains the abundance of the latter and of the fish and other sea organisms which feed on it. Another important task of the expedition was the study of fauna of economic importance. The investigations conducted on the *Vityaz* furnished a great deal of new information concerning the zoogeography of the North-west Pacific. Rich quantities of deep-water fauna, including more than two hundred new species (among them several species of fish), were discovered there. The total number of deep-water species of fish exceeds fifty. A wealth of life was found throughout the depth of the North-west Pacific, and the production of the biomass (biogenous mass) was a thousand times greater at the surface than at a depth of 6 miles. It would seem that deep-water fauna at the bottom layers is distributed according to zoogeographical regions as is the fauna in the top layers of the ocean waters. The dead organisms of the surface layers play an insignificant part in the nutrition of the deep-water bottom fauna, because they are dissolved *en route* or swallowed up by the fauna in the middle layers of the water. Deep-water fauna of the bottom layers is fed chiefly from the ground by the products of disintegration of its animal organisms. At night the fauna of the middle layers of the ocean rises in great quantities to the upper layers where it feeds on organic substances created by *algae* in daylight through photosynthesis. This fauna returns to the middle layers for the day. The greater depths are apparently populated mainly by rapacious forms. In general, however, the whole depth of the ocean waters represents an integral unit as regards the nutrition of its population.

As for the geographical investigations relating to the land, I shall dwell first of all on the results of the study of present-day tectonic movements of the Earth crust conducted by the Institute of Geography of the U.S.S.R. Academy of Sciences together with the Central Geodesy, Aerophotography and Cartography Research Institute and other organizations under the general guidance of Academician I. P. Gerasimov. They were the subject of a collective paper presented by A. V. Zhivago, L. G. Kamanin, Y. A. Meshcheryakov and M. N. Sinyagina: SOME RESULTS OF THE STUDY OF PRESENT-DAY TECTONIC MOVEMENTS IN THE WESTERN PART OF THE RUSSIAN PLAIN. These movements were investigated by combining an analysis of the data of repeated levelling with a study of the structure and development of river valleys and sea shores, and an analysis of the known changes in the velocity of the movements of the Earth's crust on the basis of multi-annual data for the level of the neighbouring seas (determined by tide gauges on the shores); due account was taken of the eustatic vibrations of the sea level. Comparisons of these data have shown that the erosions and alluviations caused by the action of rivers, formation of swamps, accumulation of peat, and similar processes in the plains are far more connected with the nature of the slow movements of the Earth's crust than was supposed earlier. A chart indicating present-day movements of the Earth's crust in the western part of the European territory of the U.S.S.R. was compiled. It shows that the western part of the Russian Plain is divided primarily into two meridional elevation zones: (1) the Estonia–Dnieper zone (connected with the Byelorussia–Lithuania, Polessie and Ukrainian bulges of the crystallic foundation of the Russian Platform); and (2) the Middle-Russian (connected with the Voronezh crystallic bulge and with the Middle-Russian Plateau). Lying between them is a zone of relative and absolute declivity. Another declivitous zone extends in a direction approximating the latitudinal, from the mouth of the Danube to the east along the Black Sea coast. It skirts the Ukrainian crystallic bulge from the south. Running around this bulge from the west is a declivitous zone which separates the

bulge from the Carpathians. Present-day movements of the Earth's crust, which are closely connected with the geological structure of the territory, are not simply a repetition of the ancient movements; available data indicate that they are closely connected with the late Quaternary movements of the Earth's crust. The average velocity of these movements in the investigated territory is about plus 3—minus 4 millimetres a year. These rates are very close to the velocity of similar movements of the Earth's crust in Great Britain and on the southern coast of the North and Baltic seas (down to the Polish border), published by H. Valentin.[1]

Much interest was aroused also by the paper on THE ANCIENT COURSE OF THE AMU DARYA IN THE LIGHT OF THE LATEST GEOMORPHOLOGICAL AND ARCHAEOLOGICAL DATA, presented by archaeologist S. P. Tolstov and geomorphologist A. S. Kes. It is known that the Amu Darya has repeatedly changed its course in geological history. In the Pliocene period it flowed westward through the Kara-Kum to the Caspian Sea; in the upper Quaternary period (Khvalynsk) it flowed northward, discharging its waters into the Aral Sea where it formed the Akhchadarya delta to the east of its present delta; in the late Khvalynsk period the Amu Darya (at its lower reaches) flowed westward into the Sarykamysh depression; after the depression was filled with water, Lake Sarykamysh fed the Uzboi River which flowed to the south and then to the west, discharging its waters into the Caspian Sea. At the end of the Neo-Caspian period the Amu Darya turned back to the north, towards the Aral Sea, and began to form its present-day delta there. Every change in its course led to the formation of a new delta. Within certain years, or decades, however, some of its water flowed also into the old beds, towards one or another of the ancient deltas. For example, archaeological studies of the ancient Akhchadarya delta have established that water coursed through some of the channels of this delta in the period between the fourth and second millenia B.C., in the late Neolithic period and in the Bronze Age. They withered away not earlier than in the first millenium before our era, when the drying channels were used by the population for building canals. Furthermore, archaeological investigations have shown that the River Uzboi existed in the period covering the end of the third and beginning of the second millenia B.C., because its valley and banks were densely populated. The Uzboi stopped flowing not later than the middle of the first millenium before our era. Later, in the sixth–fourth century B.C., the Amu Darya gave off a considerable portion of its water to the Sarykamysh depression. There were big settlements in the delta area in those days. The slopes of the Sarykamysh depression were densely populated also in later epochs, namely, in the fourteenth–sixteenth centuries A.D. In the sixteenth century A.D., the Amu Darya was again flowing into the Aral Sea. In the latest period under review, at the turn of the fourteenth century, water was again flowing in the Uzboi, though only for a very short time. It soon stopped flowing, because the level of Lake Sarykamysh began to fall rapidly. The level of this lake rose slightly in the fifteenth century, but beginning with the middle of the sixteenth century it began to dry up. A comparison of the changes in the course of the Amu Darya with the major historic developments in Central Asia since the Middle Ages has led to the conclusion that, beginning with that period, the population took an active part in regulating the course of the river. Flowing over the highest section of the subaerial delta (which is convenient for irrigation purposes), the Amu Darya easily changes its course owing to the position of its bed. At certain

[1] Valentin, H. "Gegenwärtige Niveauveränderungen im Nordseeraum" *Petermanns geogr. Mitt.* **98** (1954) 103–8; and "Present vertical movements of the British Isles," *Geogr. J.* **119** (1953) 299.

periods, the local population directed the river into its usual bed. On the other hand, in periods when the energy of the population had declined (for example, after the Timur invasion), the river was allowed to turn away into one of its ancient beds. It should, however, be added that changes in the volume of water in the Amu Darya were also bound to affect its course.

Incidentally, this point was made in another paper read at the Congress: A. V. Shnitnikow's CHANGEABILITY OF THE GENERAL HUMIDITY OF EURASIA which summed up studies of this question by the author over a period of many years. A. V. Shnitnikov told me that the periods of the settlement of the Uzboi and of the Sarykamysh depression (about 2000 years before our era, the end of the first millenium before our era, and the middle of the second millenium of our era) established by S. Tolstov's investigations saw a general rise in the humidity of Eurasia. In his paper, A. V. Shnitnikov analyses the periods of marine transgressions and regressions at the coast of Fennoscandia (through the post-Wurmian era), the periods of the advance and retreat of mountain glaciers, as well as the changes (in the latest millenia) in the condition of the alpine passages and highland settlements, pile dwellings and settlements in the floodland valleys and on lake shores; also changes in the humidity of peat bogs and swamps. A. V. Shnitnikov concludes that in addition to the intra-age rhythm of twenty to fifty years, there is a rhythm of changes in the phenomena explored by him which lasts something like 1800 years. The curves indicating the changes in each of the explored phenomena do not coincide in full, the beginning of the advance and retreat of the mountain glaciers lagging behind. But the coincidence of the general character of the curves led A. V. Shnitnikov to the conclusion that at the basis of the age-long rhythm of all the explored phenomena lies one cause, which is expressed primarily in the regular changes in the general humidity of the Eurasian continent. He does not analyse the reason for these changes. The periods when the humidity was the highest in the last seven millenia coincided with the beginning of the fifth millenium B.C., with the first third of the third millenium B.C., with the first half of the first millenium B.C. and lastly, with the middle of the second millenium A.D. The second half of our millenium witnessed a drop in humidity in Eurasia, a decline which began in the middle of the seventeenth century; the most obvious tendency towards the depletion of humidity in Eurasia and a rise in temperature begins in the last third of the nineteenth century, and is especially notable in the beginning of the twentieth century. It stands to reason that this age-long rhythm reflects only the general tendency in fluctuations of humidity; it does not at all exclude the possibility of precipitation rising in one or another year.

Other theoretical problems of physical geography were dealt with by the writer of this article in his paper, SCIENTIFIC IDEAS OF V. V. DOKUCHAYEV IN PHYSICAL GEOGRAPHY, THEIR IMPORTANCE TODAY AND WAYS OF THEIR DEVELOPMENT. This paper was devoted in the main to two basic problems of physical geography raised about fifty years ago by the eminent Russian naturalist V. V. Dokuchayev, namely: (1) the problem of the integrity and inseparable connection of the litho-hydro-biosphere (in other words, the geographical envelope of the Earth, or the geographical environment) as a single unit, all the components of which are mutually interconnected and interdependent; and (2) the problem of geographical zonality. In this respect, V. V. Dokuchayev had, of course, predecessors among Russian as well as among foreign scientists. Analysing the first problem, the writer arrives at the conclusion that the integral and inseparable character of the litho-atmo-hydro-biosphere is based on the interchange of matter and energy between the various

components of the geographical environment and between this environment as a whole and the "outside world;" namely, between the geographical environment and the universe, and between the Earth's crust and the sub-crustal envelope of the Earth. Analysing the character of the processes in this interchange, the writer shows that these processes and associated changes in the composition and structure of the geographical environment lie at the basis of the structure, dynamics and development of this environment. He views this process as a small component in the general interchange of matter and energy between various components of the universe. Noting the great distinction of forms in which the interchange between the abiotic components of the geographical environment (lithosphere, atmosphere and hydrosphere) and its bio-components (vegetation, soils and animal kingdom), as well as between the former and the latter, takes place, the writer points out that the fundamental essence of the interchange between all components of the geographical environment is one and the same. Here again, we have the opposite processes of accumulation and expenditure of matter and energy and again an interchange between the different components of the geographical environment which takes place through the constant transition of a portion of matter and energy from one component to another. This process inevitably causes constant changes in composition, and also in the structure of the geographical environment; as a rule, it tends to make them more complex—for example, as a result of the appearance of new geological structures, or of new, higher classes of organisms. A more complex composition and structure of the geographical environment leads inevitably to the development of more complex processes of interchange of matter and energy between its components (and between it and the outside world). This, in its turn, engenders in the geographical environment new geochemical or biochemical reactions and other natural processes which can lead to a greater complication of the composition and structure of the geographical environment, and so on.

The above argument leads to the conclusion that the most important features in the development of the geographical environment, that is to say the constant changeability of its composition and structure, and the tendency of this development towards increasing complication of the structure of the geographical environment and better organization of its bio-components, are determined primarily by the interchange of matter and energy between its components. It follows that the study of the problem of the interchange of matter and energy between the components of the geographical environment, and between this environment and the outer world, should occupy a special place in the study of the integral and inseparable nature of the geographical environment.

Special emphasis is laid on the radiation balance of the Earth's surface, to which attention was first called by Dr. M. I. Budyko, who directed the compilation of the charts showing the annual indices of this radiation balance over the whole of the Earth's surface. That made it possible to establish the ratio between the said balance and annual precipitation for different regions and to show (in some of the works of M. I. Budyko and A. A. Grigoryev) that this ratio is also one of the most important factors of geographical zonality.

Professor V. P. Grichuk discussed the development of geographical zones in the middle latitudes of Eurasia in the Pleistocene period. Based chiefly on a pollen analysis, it traces in the main the changes in vegetation during the Pleistocene period. The principal theses of the paper are as follows: forests, steppes, deserts and tundra were the zones existing in Eurasia outside the tropics in the late Neocene period. The tundra existed only in the extreme north-east of the Eurasian

mainland. Moreover, the forest zone of the late Pliocene was wider, extending further to the north and south than today. In the Pleistocene period, in the initial stage of maximum glaciation, the forest zone on the Russian Plain moved far to the south and merged with the forests of the Caucasus. In the epoch of the widest extent of glaciation, a special type of vegetation composed of elements of the forest, tundra and steppe plants, originated in the wide strip adjoining the glaciers (especially in the east). In the south-east of the Russian Plain, and beyond it in Asia, it was succeeded in the south by cold Pleistocene steppes. But there were extensive forests in central and east Siberia, where glaciation was confined to the highland regions. The end of the Glacial Age was followed by the gradual development of horizontal zones similar to the existing zones. In the ancient Oka–Dnieper inter-glacial period, the forest zone occupied a slightly smaller area than in the Pliocene period; moreover, forests of broad-leafed trees formed a solid Eurasian sub-zone. The northern boundary of the steppe zone was situated much further to the south than today. In the following Dnieper–Valdai inter-glacial era (the closest to us in time), the boundaries of the forest zone approximated to those of today and the solid Eurasian broad-leafed forest sub-zone did not exist. There were the forest-steppe and steppe zones to the south of the forest zone, and tundras probably existed in the north.

Mention was made (on page 435) of M. I. Budyko's work on geographical charts to show the annual radiation balances of the Earth's surface. Professor Budyko read at the Congress his paper RADIATION AND HEAT BALANCES OF THE U.S.S.R. AND THE GLOBE, which dealt with the work, under his direction at the Voyeikov Central Geophysical Observatory, of compiling a series of charts (of the world and of the territory of the U.S.S.R.) to illustrate the geographical laws governing the transformation of solar energy on the Earth's surface, in a year and for every month. This series of charts contains the indices of the total short-wave radiation, of the radiation balance of the Earth's surface, of evaporation and expenditure of heat on evaporation, of turbulent heat exchanges of the sub-surface and the atmosphere, as well as a chart showing the amount of warmth received or lost by the surface of the ocean in a year in connection with the action of the sea currents. These charts are valuable for the treatment of general problems of physical geography, and of the problems of geographical zonality in the first place, because, as Budyko notes, in order to study the interaction of natural processes it is necessary to have an idea of the geographical laws governing transformation of solar radiation (on the Earth's surface). For this is the principal energy base of all the natural processes at work there. Annual charts of this series were published in 1954.

Another factor of great value for the treatment of general problems of physical geography is the distribution of the humidity on the Earth's surface and a correct idea of the natural processes at its basis. These questions were dealt with by Dr. O. A. Drozdov in his paper, MOISTURE CYCLE ON A LIMITED PART OF DRY LAND. O. A. Drozdov singles out two basic questions in the moisture cycle problem: the relationship between precipitation formed of advective vapours, and precipitation formed as a result of evaporation from a limited surface; and, secondly, the influence of local evaporation on precipitation. He approaches these two questions in an entirely new way. At the same time he shows that the latest calculations of the coefficient of the moisture cycle (i.e. the ratio between total precipitation and outside precipitation) for Eurasia disprove the old theories; for example, for the European territory of the U.S.S.R. the said coefficient varies between 1·12 and 1·35 for different places. Moreover, he emphasizes that the figures for the coefficient of the

moisture cycle cannot serve as ground for concluding that local evaporations play an insignificant part in determining precipitation on extensive territories. The importance of local evaporation is that, by raising the humidity of the air indirectly and in connection with changes in temperature, it stimulates precipitation from water vapours of internal and outside origin, and this increases by 200–300 per cent. the importance of local evaporation for precipitation in comparison with the increase in "local precipitation." Drozdov points out that investigations have revealed that the relationship over a territory ranging from three quarters of a million to one million square miles between precipitation and advection of humidity is greater in the cold season. In the warm season this connection is best expressed in the northern districts, where the probability of precipitation is greater. The disparity between advection of moisture and precipitation may be considerable in the steppe districts. For example, in the arid year of 1946, advection of humidity in the south European U.S.S.R. was observed practically within the same limits as in ordinary years, whereas precipitation was far below normal. The role of circulating factors (rising currents) in the formation of precipitation in the steppe regions is almost equivalent to the joint action of the general volume of moisture and the relative humidity of the atmosphere. In the humid regions they play the dominating role. After atmospheric circulation, evaporation from dry land is the second important factor determining the humidity of the continent. The uneven surface of the land, in particular the relief, exerts a very great effect on the redistribution of precipitation, but it has less effect on the humidity of the continent as a whole. The effect of the elevations on the European plain is expressed in the redistribution rather than in the increase of precipitation, and their influence on the intensity of the moisture cycle is rather unfavourable in view of uneven precipitation.

Along with papers summing up the results of the geographical discoveries and study of theoretical problems in the last few years, the Congress devoted much attention to the application of geographical sciences to the solving of agricultural problems.[1] Two papers were concerned with the problem of rational utilization of the snow cover, and the problem of erosion. Professor G. D. Rikhter analysed the progress made in studying the snow problem and the nature of the methods recommended for regulating the thickness of the snow cover in the fields and along the roads. He showed that as regards the most rational use of the snow for farming purposes the territory of the U.S.S.R. could be divided into several big zones. Snow retention and even distribution of the snow over the fields, which was widely practised in the arid regions, has done much to raise the crop yields there. In the northern (forest) regions, where surplus moisture is a problem, measures are necessary to accelerate snow thawing in the fields. In districts where dry years alternate with extremely wet years, it is necessary to alternate the measures outlined above. One of the most important problems requiring elaboration is that of defining the different schemes for snow amelioration in different districts and of methods for mechanizing labour.

D. L. Armand distinguished between normal erosion and accelerated erosion, both caused by water. The first is a slow process which causes no damage to agriculture, whereas the second destroys the soil and vegetal cover and causes much damage. In natural conditions, the second type of erosion is rare in the moderate zone; but with the economic development of the territories it may become widespread even on very gentle slopes. As a result of accelerated antropogenic erosion,

[1] See A. A. Grigoryev, "Soviet plans for irrigation and power," *Geogr. J.* **118** (1952) 168–79: and "The reclamation of the forest belt of the U.S.S.R." *Geogr. J.* **119** (1953) 411–19.

the soil is rapidly washed away and the cropland is broken up (ditches, ravines, etc.) with the result that mechanization of farming becomes impossible. Furthermore, the extensive use of agricultural machinery in the fields of the U.S.S.R. may itself become a source of erosion caused by the action of water. This must be taken into account in the design of machines and in the elaboration of methods for their exploitation. The possibility in the U.S.S.R. of extensive planned use of anti-erosion measures on vast territories should ease the struggle. A whole set of measures is required in districts subject to widespread erosion: (1) special agro-technical methods, such as shuttle ploughing, for example, fallow ploughing without turning the soil, intermittent furrowing, etc. Special types of machines should be produced for this purpose. (2) Planting of windbreaks, mainly around reservoirs and not along great dents, and decidedly not along slopes. Shelter belt planting should be combined with the creation of artificial microreliefs. (3) Greater use of perennial grasses in crop rotations, and a correspondingly greater stress on live-stock farming. All these measures should be based on good knowledge of the land, and of its relief in particular. Stations for the experimental study of erosion processes in various natural conditions should be set up on experimental farms.

The rational distribution of farm crops is as important for agriculture in the U.S.S.R. as is the study of the agromelioration problem. To solve these problems it is necessary to evolve a thoroughly substantiated scheme of natural and economic divisions and subdivisions of the U.S.S.R. The great amount of work done by the U.S.S.R. Academy of Sciences (the Council for Studying Productive Forces, together with the Institute of Geography and other institutes of the Academy) was reported to the Congress by P. A. Letunov in his paper NATURAL AND ECONOMIC DIVISION OF THE TERRITORY OF THE U.S.S.R. FOR AGRICULTURAL PURPOSES. This paper was illustrated with maps compiled by a group of scientific workers. The territory of the Soviet Union has been divided into eighteen zones, according to specialization of agricultural production. These zones have been determined by an analysis of the regional data of the existing structure of the cultivated areas, e.g. available labour resources, distribution of the urban population, big industrial areas and industrial centres, and the distribution of enterprises engaged in the processing of agricultural raw materials; and by an analysis of the regional transportation of certain agricultural produce by rail, and of the natural conditions of the respective zones (soils, climate, relief, vegetation, surface and ground water). Intra-regional agricultural micro-districts are being defined at present. The demarkation of these districts is based on an analysis of the economic indices of the state of agriculture today, of its specialization and its equipment, with the means of production, available labour resources, etc., in every part of the given region, due account being taken of their specific natural conditions. The concluding stage in this extensive research should be the characterizations of the economic and natural resources of every agricultural enterprise (collective farm and state farm), definition of their most rational specialization and their production type, i.e. a definite combination of the leading and auxiliary branches of farming and the scientific elaboration of a long-range plan of their development.

The scientific substantiation of the agricultural specialization and development of big state farms and collective farms in Northern Kazakhstan and the Altai Territory, undertaken by a combined expedition of the U.S.S.R. Academy of Sciences in 1954–5, jointly with other institutions, was the subject of a special report from the leader of the expedition, Professor V. D. Kislyakov, in a paper entitled NATURAL CONDITIONS OF VIRGIN AND LONG-FALLOW LANDS IN THE EASTERN

DISTRICTS OF THE U.S.S.R. AND THE TASKS OF GEOGRAPHERS IN THEIR STUDY. The latest achievements in Soviet cartography were dealt with in the general survey of Professor K. A. Salishchev: SOVIET CARTOGRAPHY, ITS PRESENT STATE AND TASKS; it summed up the successful work of a large group of Soviet cartographers on improvements in maps. Great accomplishments in the improvement of topographical maps were reported by A. B. Rogov in his paper: TOPOGRAPHICAL MAPS OF THE U.S.S.R. AND WAYS OF THEIR IMPROVEMENT. In his report, MARINE ATLAS, L. A. Demin described the valuable content of this basic atlas which was published recently. In his report on the ATLAS OF THE WORLD, S. I. Shurov described the big atlas published in 1954, containing a number of excellently executed maps.

Among the papers read at the plenary meetings, special interest and the liveliest exchange of opinions were roused by Academician I. P. Gerasimov's report on the STATE AND TASKS OF SOVIET GEOGRAPHY AT THE CURRENT STAGE OF DEVELOPMENT, and Professor V. F. Vasyutin's PRINCIPLES OF DISTRIBUTION OF SOCIALIST PRODUCTION AND THE TASKS OF ECONOMIC GEOGRAPHY. These papers summed up the constructive suggestions on the most important theoretical problems of physical and economic geography discussed in the last five years.

The Congress concluded that the most important theoretical and practical tasks of Soviet geography at present are: the promotion of integrated geographical field investigations and of cartographic work concentrated on the study of natural resources and the development of the productive forces in all regions of the country. In physical geography attention should be concentrated on the development of scientific investigations for furthering the exploitation of the country's natural resources. Especially important is the work connected with the transformation of the water and heat regime in agricultural areas with a view to raising their productivity and weakening and eliminating the effect of swamps, drought, erosion and similar natural processes. Among the most important tasks in economic geography is the study of the laws governing the geographical distribution of production, geographical division of labour and the formation of economic districts; the economic appraisal of natural conditions and resources; the combined study of the geographical distribution of industry, agriculture and transport, on the one hand, and of the districts, on the other hand; and of demogeography. One of the most important scientific problems is that of the division of the country into economic districts.

THE 1837 MAPS OF HENRY DRURY HARNESS

ARTHUR H. ROBINSON

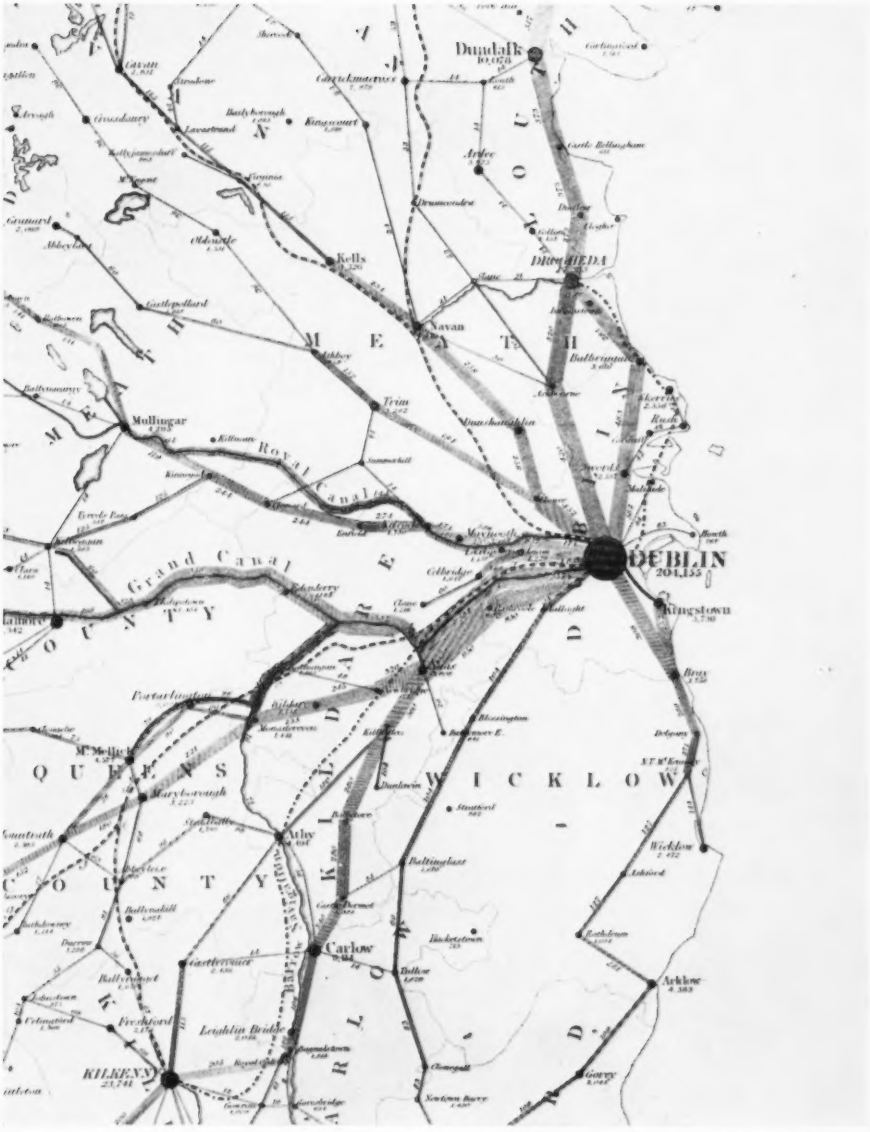
HISTORICAL CARTOGRAPHY usually concerns matters prior to 1800 and as a consequence the story of the beginnings of modern cartographic technique largely exists only in fragmentary outline. There have been, to be sure, numerous chronicles of the development of modern survey and the detailed mapping of the land, but the birth and growth of small scale or "geographic cartography" and its relation to other cultural change is fully as fascinating as the other elements of cartographic history. The methodology of small scale cartography is commonly assumed to have had a slow and steady development from crude beginnings to its present supposed high state. A cursory examination shows this not to be the case.

The period 1835–1855 might well be termed a "golden age" of the development of geographic cartography. Certainly this period witnessed one of the more remarkable "spurts" in development that has occurred in recent cartographic history. During this twenty-year period almost every technique now known for representing population numbers, distribution, density and movements seems to have come into being. The combination of the industrial revolution, the rise of mechanical transportation, the initiation of the great topographic surveys, the institution of censuses, and the proliferation of physical and social science investigation and education all combined to produce an environment in which geographical cartography would naturally flourish. This paper is not the place to examine in detail the origins of statistical and population cartography, but a short résumé of the status of our knowledge is appropriate.[1] Secondary sources are few and by no means complete.[2] For example, they tell us that no map of population distribution or density is known before almost mid-nineteenth century; flow maps are said to have originated in 1844, graduated circles on maps somewhat later; the dasymetric technique is supposed to have originated towards the end of the nineteenth century; and, with but a few exceptions, the statistical cartographic techniques are stated as having their origin on the continent. We can now trace our origins back somewhat further in these respects (and others), for each of these techniques was employed earlier in England on a series of maps which, in my opinion, qualifies as one of the more remarkable sets of maps ever made. They were constructed in 1837 to accompany the Second Report of the Irish Railway Commissioners.[3]

[1] This study was supported by the Graduate School of the University of Wisconsin. Research of this kind, conducted away from the main repositories of the source materials, is dependent upon the help of others, viz., Richard Dahlberg, research assistant, the reference staff of the University of Wisconsin Library, Professor Andrew H. Clark, and Professor Emeritus Howard Robinson. Especially helpful was Mr. R. A. Skelton, Superintendent of the Map Room of the British Museum.

[2] The best, to my knowledge, are: H. G. Funkhouser, "Historical development of the graphical representation of statistical data," *Osiris*, 3 (1938) 269–404 (contains a large bibliography); Max Eckert, 'Die Kartenwissenschaft' (2 vols.), Berlin and Leipzig, 1923–5; Étienne Jules Marey, 'La méthode graphique dans les sciences expérimentales et principalement en physiologie et en médicine,' 2nd Edition, Paris, 1885.

[3] 'Atlas to accompany the Second Report of the Commissioners appointed to consider and recommend a General System of Railways for Ireland, Presented to both Houses of Parliament by Command of His Majesty,' H.M.S.O., Dublin, 1838. Two copies of the atlas are known to me—one in the British Museum and another in the Library of Congress.


Dundalk
10,078
Ardee
Kells
3,225
Navan
Trim
2,542
Mullingar
4,253
Royal Canal
Grand Canal
DUBLIN
204,155
Kingstown
3,730
Drogheda
Balbriggan
Ashbourne
Swords
Malahide
Howth
Bray
3,758
Delgany
Wicklow
2,432
Arklow
4,383
Rathdrum
Baltinglass
Tullow
1,670
Carlow
9,944
Castledermot
Athy
4,016
Maryborough
3,223
Portarlington
Edenderry
2,128
Clane
1,128
Celbridge
2,237
Naas
3,746
Blessington
Donaghmore
Dunlavin
Stratford
Rathangan
Monasterevan
1,448
Kilcullen
Prosperous
Kilmeague
Timahoe
Kilmacshane
Ballymore E.
Ballymore
Ballitore
Kilkea
Castledermot
Ballyshannon
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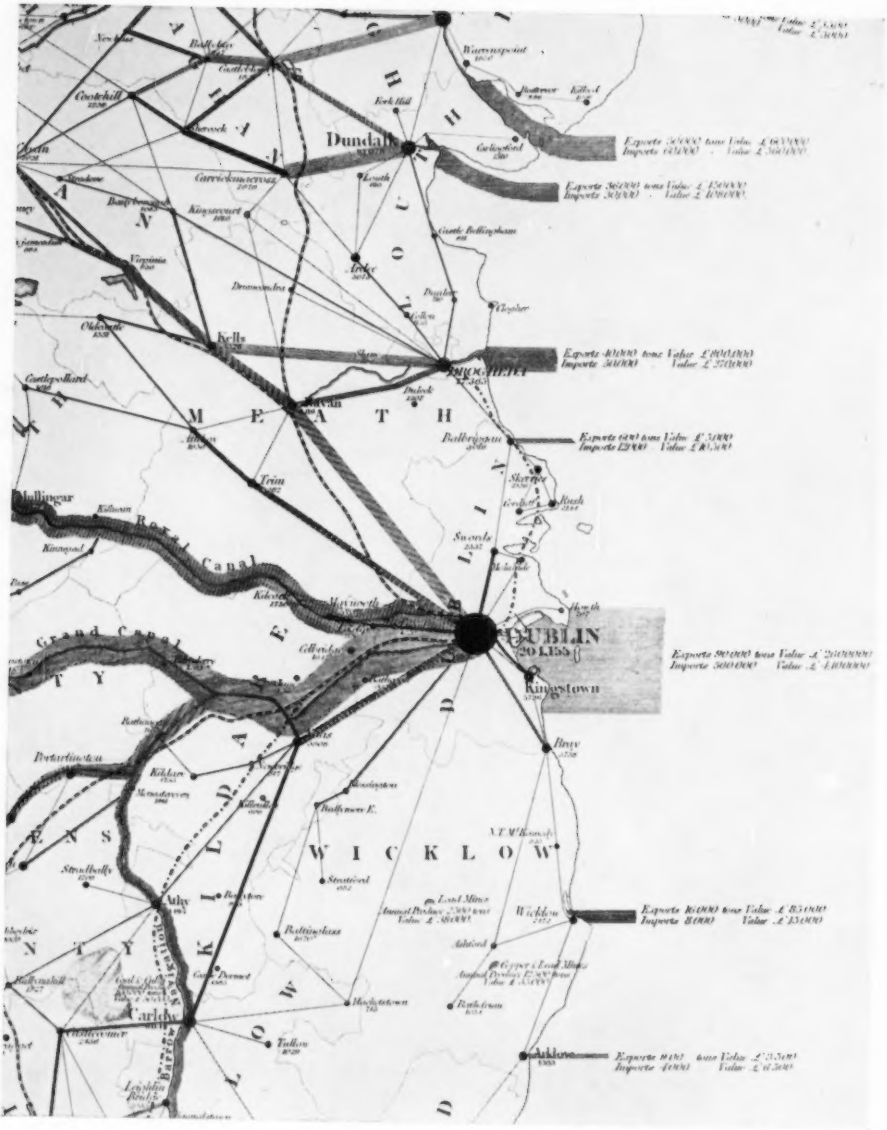


Section of Harness' Traffic Flow Map, 1837. Original, 1 inch to 10 miles. Brit. Mus.

Soon after the steam railway was shown to be a practical method of communication there occurred a rapid expansion of lines and branch lines, particularly in England and Scotland. Considerable confusion with respect to financing and the rôle of the state resulted. Thomas Drummond, Under Secretary of State for Ireland, suggested that a Railway Commission be established to study the matter for Ireland. In October 1836 the Commission was appointed with Drummond as its Chairman. The other Commissioners were Sir John Fox Burgoyne, Chairman of the Board of Works, Richard Griffith, the well-known geologist and engineer, and Peter Barlow, Professor of Mathematics in the Royal Military Academy at Woolwich. The Commission made a short progress report in 1837 and issued its final report in 1838. The Second Report was accompanied by an Atlas, which appeared late on account of engraving difficulties. It contained maps of various kinds among which were some described as follows: ". . . with a view of placing, as it were, before the eye a picture of the country, representing the distribution of its population and its traffic, whether of goods or of passengers, illustrative maps, *on a new design*, have been prepared, of which the construction shall be explained in treating of the subjects to which they relate." [1] In addition to the population and traffic maps referred to, the Atlas contained a smaller geologic map and two general maps of Ireland at a larger scale of 4 inches to 1 mile. One of these was hachured and contained boundaries of geological formations and the other was contoured, and they too are the first of their kind.[2] Everything considered, the maps made to accompany the Second Report of the Railway Commissioners were a remarkable group, but we shall pass over the ones which have received more appropriate recognition and concern ourselves with the three population and traffic maps which have been all but forgotten. Of these three maps our major concern in this paper is with the population map.

The author of these maps was Henry Drury Harness, R.E., who had a long and distinguished career of military and public service. During their preparation he was associated with some remarkable men and the time was one of rapid scientific development. Before considering more closely the author, his associates, and the cartographic environment in which the Harness maps appeared, we shall first examine the maps themselves.

The Harness Maps.—Harness prepared three maps for the Second Report of the Railway Commissioners, two of which were concerned directly with the population of Ireland. The third presented information concerning the movement of goods. All three maps are unusual in that they are, to my knowledge, the first to use several cartographic techniques, which have been improperly credited to others, and in any case the maps themselves have received almost no mention in the geographical or cartographical literature. That these maps had some influence upon the work of later cartographers seems most likely.

[1] Second Report, *op. cit.*, p. 3 (italics in quotation mine).

[2] The geologic map was the first of Ireland, see J. W. Judd, "The Earliest Geological Maps of Scotland and Ireland," *Geol. Mag.*, New Series, Decade IV, **5**, 4 (1898) 145–9. The Commissioners felt the need of a general map since the triangulation for the National Survey of Ireland was complete at this time, but only about a third of the island has been covered with maps. Lieutenant Thomas A. Larcom, R.E., then the local superintendent of the Irish Survey at Mountjoy, was entrusted with the preparation of a general map at a scale of 4 miles to 1 inch and "it was due to him that the continental system of delimiting contours on maps was introduced into the Survey of the United Kingdom for the first time." See T. Pilkington White, "The Romance of State Mapping," *Blackwood's Edinburgh Magazine*, **144** (1888) 384–98, 548–64, reference on p. 556.

Each of the three maps bears the main title "Map of Ireland to accompany the Report of the Railway Commissioners" and the subtitles are as follows:

1. "Showing the relative Number of PASSENGERS in different Directions by regular PUBLIC CONVEYANCES."
2. "Showing the relative Quantities of TRAFFIC in different Directions."
3. "Showing by the varieties of shading the comparative Density of the POPULATION."

Beneath the title each map bears the statement "Constructed under the Direction of the COMMISSIONERS, by Henry D. Harness, Lt. Royal Engineers, 1837." The maps are drawn to the same size, approximately 26×32 inches, and to the same scale of 1/633,600 or 10 miles to 1 inch. The representative fraction does not appear. They were engraved by J. Gardner, Regent Street, London.

The background or base data of the maps is similar. Each contains the county boundaries as well as the principal towns and cities, all of which are named. The populations of towns having more than a few hundred inhabitants are also listed under the town names. Except for the very small ones, each town and city is shown by a shaded circle whose size is proportional to the population in 1831. Each of the maps has a legend, or "References," and a scale of statute miles. The legend is primarily for the purpose of making clear the distinctions between the symbols for the three categories of existing or projected railway lines which appear on each map as background data. The three maps are neither identified by number on their faces nor are they referred to in the Report in any way other than by title. Our primary interest at this time is in the population map but, before turning to it, it would be well to take a brief glance at the Conveyance and Traffic maps.

The Conveyance map was ". . . intended to exhibit . . . the relative number of travellers . . . conveyed in different directions throughout Ireland." [1] Plate 1 is a portion of this map showing the region in the vicinity of Dublin. The flow lines are shaded and the varying widths are properly proportional to the numbers that appear along them. These numbers are, in the words of the legend on the map, ". . . the average Number of Passengers conveyed in one Direction Weekly." The flow lines are, in general, drawn directly between connecting points, thus showing only travel between them rather than the actual route followed. This is a map of remarkably modern appearance, and it may come as somewhat of a surprise to contemporary traffic engineers that such a map was prepared over a century ago.

That Harness, or at least someone associated with the construction of these maps, was unusually ingenious is shown by the manner in which the data were derived for this traffic map. Harness wrote in his explanation that the map ". . . was constructed, almost exclusively, from data supplied by the Constabulary." [2] These data were gathered by means of what Harness called "blank returns," i.e. questionnaires. These questionnaires were distributed to each constabulary district and requested a description of the public conveyances noted as well as the average number of passengers in each for a one-week period. These were then evaluated against one another, since each report was duplicated by at least one other police station. In addition Harness obtained a list of the public conveyances in Ireland and

[1] "Report from Lt. H. D. Harness, R.E., Explanatory of the principles on which the Population, Traffic and Conveyance Maps have been constructed," Appendix III to the Second Report of the Commissioners . . . etc., *op. cit.*, p. 41 of Appendices.

[2] *Ibid.*

used the reports from the three largest "coach and car proprietors" in Ireland as a control. In his summary Harness stated that:

". . . it is believed that the numbers given on the map are a tolerably correct average of the number of passengers conveyed weekly . . . and as the number of such passengers may be considered a very fair proportional measure of the whole number of travellers in any direction, the streams of shade [the flow lines], of which the breadths have been proportioned to those numbers, may be considered as conveying a faithful picture of the relative amount . . ." [1] He did not allow the extremes of his data to ruin the visual effectiveness of his map, as has been the case with some modern counterparts. For example, he did not attempt to symbolize the extraordinary number of passengers travelling weekly between Kingstown and Dublin, but instead placed a note about it in the legend.

The Traffic map (Plate 2) is similar to the Conveyance map in design. The map shows internal and external traffic in merchandise by means of lines of variable width. Harness was, however, considerably less sure of his data compared to those for the previous map. He explained his procedure as follows:

"The returns employed for determining the inland traffic were obtained from the Constabulary; . . . Since, generally speaking, no reliance could be placed upon actual amounts . . . the direction of the trade was at first alone attended to, and a line for each stream of trade as reported by a Constable . . . was drawn upon a map; many towns, uniting to send their produce in the same direction, made these thick . . . and . . . the streams of produce on the Grand and Royal Canals, which were found to bear very nearly the same proportion to each other, that their traffic does, as exhibited in Porter's Tables, were taken as equivalent to the number of tons shown by those tables, to be conveyed by them; this supplied a scale; those streams for which anything like definite information respecting weight had been obtained, had their breadths corrected by that scale, and others were left unaltered." [2] Thus wrote an honest cartographer.

The Population map (Plate 3) contains the same base data that appear on his other two maps and shows in addition the barony boundaries but without names. The rural population from the 1831 Census, or to be more exact, the non-city population, is shown by aquatint shading, the darkest being the most densely populated. About one hundred population density figures, e.g. 230, 280, etc., are scattered over the map in addition to the shading, in order, according to the legend, ". . . to denote the average Population per square mile on the parts where they are placed."

Harness intended that the shading should exhibit four categories of population density,[3] but the lack of control over the aquatint process unfortunately caused the categories to shade somewhat into one another. For example, in County Meath the value 170 is placed on three different densities of shading, and the value 200 in County Wicklow is darker than 200 in County Wexford. Over much of the map the density class boundaries are sharply drawn and the intention of Harness is clear: but in other instances the density classes grade imperceptibly from one to another, and the boundaries separating them are consequently ill-defined. The figures of population density on the map were tabulated and plotted on a frequency diagram. A study of this diagram and a comparison of it with the map failed to reveal the class limits.

[1] See note 1, page 442 (opposite).
[2] *Ibid.*, p. 42.
[3] Second Report of the Commissioners . . . etc., *op. cit.*, p. 3.

The density classes are placed upon the map by the dasymetric method. This method of representation employs areal symbols, e.g. shading, which are bounded by lines which neither correspond with administrative boundaries nor are isopleths. In the preparation of a dasymetric map one proceeds as follows: the administrative area (barony in this case) wherein there are obvious differences in density is divided in two parts. An assumption is made as to the density of one part and then, by a relatively simple equation, one solves for the density that must be accorded the remaining part in order that the two values so derived are consistent with the average density of the whole administrative division.[1]

The positioning of the density class boundaries is inconsistent. In some areas the density class boundaries bear no relation to administrative boundaries, which is to be expected when the dasymetric technique is utilized. In other places, however, the class boundaries clearly coincide with administrative boundaries, as is usual when the choroplethic technique is used. Moreover, in certain instances the boundaries are irregular and appear not to follow administrative boundaries, but a comparison with a more detailed administrative map suggests that the method was perhaps actually choroplethic even though the lesser administrative boundaries do not appear on the Harness map. Whatever the appearance of the map may be, there is no question whatever that Harness employed, or tried to employ, the dasymetric technique. His own explanation states clearly the procedure he followed:

"The first map is intended to convey, at once, to the mind, an idea of the manner in which the population is distributed over the country; and for this purpose, the depth of shade applied to each part has been regulated by the density of population. The Parliamentary Census of 1831 gave the number of inhabitants; the Ordnance Maps, so far as they are published, gave the acreage of each barony; and for those not surveyed the Commissioners supplied the supposed areas. From these data, the number of inhabitants, per square mile, in each barony was determined, after deducting the population of the towns intended to be shown upon the Map, and the relative depth of shade for each barony was expressed by the numbers thus obtained. The towns are represented by dark spots, of which the areas are regulated by the number of their inhabitants.

"It was at first proposed to abide throughout by the principle just described; but the Commissioners having expressed a wish that something more detailed than shading, by baronies, according to their average population, should be attempted, they marked upon a map, such barren tracts of bog and mountain as they knew to contain but few inhabitants; assigning also, from their general acquaintance with the country, what they supposed might be assumed as the population, per square mile, in such parts. The population of each barony, containing a portion of these boggy and mountainous tracts, was therefore considered, after allowing a few inhabitants to the barren parts, to inhabit the remaining portion, and the population, deduced for that part, from the data thus furnished.

"In order that definite information, respecting the population of the country, may also be afforded by this map, the number of inhabitants, per square mile, in different parts, has been engraved upon it in figures, and also the population, in 1831, of the different towns." [2]

[1] See John K. Wright, "A method of mapping densities of population with Cape Cod as an example," *Geogr. Rev.* **26** (1936) 103–110, or Arthur H. Robinson, 'Elements of cartography,' Chapman and Hall, London, 1953, pp. 187–90, 239–41.

[2] "Report from Lt. H. D. Harness, R.E., Explanatory of the principles on which the . . . Maps have been constructed," *op. cit.*, p. 41.

The city populations in 1831 are shown on the map by figures under the names, and are also symbolized by spots or circles whose areas are proportional to their populations. This procedure does not apparently extend to the entire range of cities, for the very small ones are shown by what appear to be circles too large to be in proper proportion, and in addition many small places do not have population figures appended.

In spite of its defects this is a thoroughly remarkable map, as are the other two in this set, for when placed in the perspective of the period when they were constructed they stand as monuments of ingenuity.

Henry Drury Harness and others connected with the Railway Commission Report. —Henry Drury Harness was born in 1804.[1] He graduated from the Royal Military Academy at Woolwich in 1824, but no commissions being available in the Royal Engineers he went to Mexico as an engineer with a silver mining company. When a commission became available he returned in 1826 to accept it. He was a student at the Royal Engineers' School at Chatham for a short time and then went to Bermuda with the Royal Engineers until 1834. He was raised to the rank of Lieutenant in 1832 and in 1834 was appointed instructor in fortification at Woolwich, which post he held until 1840. In 1839, after his service with the Railway Commissioners, he was offered, and declined, the post of Surveyor General of South Australia. He was appointed Instructor in surveying at Chatham in 1840. Thereafter he served as Deputy Master of the Mint, Commissioner of Public Works of Ireland, Officer in charge of the Fortifications Branch of the War Office and Director of the Royal Engineers' School at Chatham. He was a man of amazing vitality and unusual integrity, and was frequently called upon to serve the government in tasks requiring these attributes, such as reorganizing the Mint or acting as referee in allocating funds in railway post office matters. He died in 1883 as General Sir Henry Drury Harness, K.C.B.

Other than the three maps which are the subject of this paper Harness' bibliography contains no entry which concerns cartography, geography, or statistics *per se*.[2] Certainly there is nothing in his background which would indicate any competence in small scale cartography. Why he was chosen by the Railway Commissioners to undertake the three maps is not known, but it is possible that it was a consequence of the appointment as a commissioner of the well-known investigator and mathematician Professor Peter Barlow. Professor Barlow and Lt. Harness were both teaching at Woolwich at the time. I have been unable to find any reference to Harness having exhibited any unusual statistical or cartographic talents prior to this time. In any case Lt. Harness performed his duties relative to the Railway Commission's maps with dispatch and apparently they were pleased with his work. In March 1838 he received a letter from the Secretary of the Railway Commission stating in part, that ". . . they [the Commissioners] have expressed

[1] Accounts of the life and accomplishments of Henry Drury Harness are contained in the Dictionary of National Biography, London, 1917, Vol. 8, pp. 1298–1300; T. B. Collinson, 'General Sir Henry Drury Harness, K.C.B., Colonel Commandant Royal Engineers, Royal Engineers Institute Committee,' London, 1903; Obituary: "Sir Henry Drury Harness," *Mon. Not. R. astr. Soc.* **44** (1884) 133–5; Memoir: "General Sir Henry Drury Harness, R.E., K.C.B.," *Roy. Engrs' J.*, 2 April 1883; also abridged in *Min. Proc. Instn civ. Engrs*, 1882–3, Part III.

[2] "On Contoured Plans and Defilade," *Papers on Subjects Connected With the Duties of the Corps of Royal Engineers*, **2** (1838) 75–90; "Description of a Small Observatory erected at Chatham, for the Use of the Officers of the Corps of Royal Engineers," *ibid.*, Vol. 7, 1845, pp. 64–8; "On Suspension Bridges," *ibid.*, Vol. 9, 1847, pp. 145–8. He was also author of a text-book on fortification popularly known as "Harness' Papers."

themselves highly pleased with the manner in which you have executed the maps, which cannot fail to be documents of high interest to everybody connected with Ireland.

". . . The Commissioners have desired me to place to your credit . . . the sum of £200 which they think very reasonably due to you." [1] Such remuneration seems unusual to say the least, for £200 was the equivalent of many an annual salary in 1838. We may suppose that Lt. Harness was put to considerable expense in connection with his work, but unfortunately it has been impossible to examine the Corps records, the records at Woolwich, the Ordnance Survey records, or the record of disbursements of the Railway Commission. In any case the letter above was included in the lengthy memoir as evidence of the gratitude of the Commissioners and not as payment of expenses. If this be true Harness set still another precedent with respect to cartography that unfortunately has not been consistently followed —he was handsomely paid for his services.

Two questions present themselves: what was the state of small-scale statistical cartography at this period, and the corollary question, how could Henry Drury Harness prepare the maps he did in 1837? The early part of the nineteenth century saw the beginnings of national censuses and it is to be expected that the techniques of their cartographic presentation would have been crude. Contemporary textbooks on cartography ignored statistics, and wherever one looks, one rarely encounters even the simplest of statistical presentations. The decade of 1830–1840 saw the birth of many of the scientific and statistical societies in the British Isles, and, so far as I can determine, by 1837 none of them had published anything in its journal which might remotely have given guidance to one looking for cartographic ideas. The International Statistical Congress, which did concern itself somewhat with cartography, did not come into existence until the following decade. Prior to 1837 there had been published, to my knowledge, only a few statistical maps and none outside the continent. These few were crude and in no way match the sophistication of the Harness map.[2]

It is much more likely that the Harness maps were essentially new ideas, arrived at independently. It also seems reasonable to postulate that the design of the maps and the techniques used thereon were more a result of cooperative discussion and planning by the commissioners and their associates than the product of Harness alone. It must be emphasized that there is no direct evidence of this, but the commissioners and their associates were such an unusual group that it seems most likely.

Thomas Drummond, First Commissioner, was noted for his mathematical ability and ingenuity in connection with many things, such as, for example, the "Drummond Light" for geodetic work, or the devising of indices for proportional representation purposes for the Reform Bill of 1831.[3] If Drummond had designed such maps, one would not think it unusual. Professor Barlow, "The representative on the Commission of the Science of the day," [4] and perhaps Mr. Richard Griffith,

[1] Letter dated 6 March 1838 to Harness, Lt. H. D., R.E., Woolwich, from Harry D. Jones, Secretary, Railway Commissioners, quoted in T. B. Collinson, *op. cit.*, p. 36.

[2] The first by Dupin appeared in 1819 followed by those of Balbi and Guerry in 1829 and Quetelet in 1832 and 1835. So far as is known there were no others. See H. G. Funkhouser, *op. cit.*, pp. 269–404, reference p. 298 ff.

[3] Larcom, Thomas A. "Memoir on the Professional Life of the late Captain Drummond," *Papers on Subjects Connected with the Duties of the Corps of Royal Engineers*, 4 (1840) ix–xxiv.

[4] *Ibid.*

could have had such novel ideas, but it intuitively appears more than likely that Harness may have received his greatest guidance from Thomas A. Larcom, then in charge of the Ordnance Survey Office at Mountjoy.

The evidence at hand does not permit this assumption, and consequently no purpose would be served by a complete listing of all the attributes and accomplishments of Sir Thomas Aiskew Larcom, K.C.B.[1] Born in 1801, he too was educated at Woolwich and joined the Corps of Royal Engineers. He began work with the Ordnance Survey in 1824 and went to Ireland in 1826. In 1828 he was made assistant to Colonel T. F. Colby, the Director of the Ordnance Survey. At the time the Railway Commission was performing its investigations Larcom was local superintendent of the Survey Office at Mountjoy, Phoenix Park, Dublin.[2] He was the cartographic author of the six-sheet general map and the geologic map prepared for the Railway Commissioners.[3] This was ". . . the first general map ever made in Europe on which the ground was completely delineated as one whole." [4]

Larcom appears to have been a most unusual man. He was devoted to statistics and their quality, and his ingenuity in a variety of fields ranging from statistics to map reproduction, suggests that he is the most likely person to have advised Harness, not only on the cartographic techniques but on the statistical procedures as well.

It is not, on the other hand, the purpose of this paper to depreciate Henry Drury Harness who would have been, and was, a remarkable man had he never made the maps for the Railway Commission. Nevertheless, it hardly seems possible that one individual, who had no statistical or small-scale cartographic background, could by himself be the originator of so many new techniques all at once. Yet to my knowledge nothing remotely like these maps preceded them, nor is there any evidence whatever that anyone, including the commissioners and Larcom, advised or helped him beyond the obvious fact that they must have been closely associated in the Railway Commissioner's task.

Reactions to the Harness Maps.—The Second Report of the Railway Commissioners attracted considerable attention both as a document touching upon matters of great current interest (especially in Ireland), and as an example of careful and detailed investigation of a complex subject. The maps by Harness came in for their fair share of attention, and apparently there was, at the time, some appreciation of their novel character.

The Report of the Railway Commission was abstracted and presented to the Statistical Section at the Eighth Meeting of the British Association for the Advancement of Science, but in the printed abstract no mention of the maps was made.[5] The same author prepared a much longer communication for the Statistical Society

[1] See Dictionary of National Biography, Vol. 11, pp. 584–6, and other references noted therein.

[2] White, T. Pilkington, *op. cit.*, p. 556.

[3] Portlock, J. E. "Memoir of the Late Major-General Colby, R.E., . . . etc., with a sketch of the origin and progress of the British Trigonometrical Survey," *Prof. Pap. Cps R. Engrs*, New Series, **3** (1853); **4** (1855); **5** (1856). Reference in Vol. 4, p. xxiii; also Transactions of the Geology Section, British Association for the Advancement of Science, Newcastle Meeting, 1838, *Rep. Brit. Ass.* **8** (1838) 81, which reports in part "Mr. Griffith exhibited his new Geological Map of Ireland which had been constructed at the Ordnance Survey Office, Dublin, by Lieutenant Larcom . . ."

[4] "Obituary of Sir Thomas Larcom," *Proc. roy. Soc.* **29** (1879) x–xv.

[5] Rawson, W. R. "Abstract of the Report of the Railway Commissioners in Ireland," *Rep. Brit. Ass.* **8** (1838) 171–2. (Author's initials reversed.)

of London.[1] In this, considerable mention of the Harness maps is made and the author evidently appreciated their quality and novel nature, for he explains that "In illustration of this part of the Report, some beautiful maps on a new plan are given, which places before the eye a picture of the country, representing the distribution of its population and traffic . . ." Although it is not certain that Rawson exhibited the maps to the Statistical Society he did describe them sufficiently to give some idea of their character.

In 1838 a report to the Royal Geographical Society by the Society's Secretary, Captain J. Washington, R.N., had a reference to the recently published Harness maps. Captain Washington reported that "A curious statistical map of Ireland has also been engraved by Mr. Gardner, from a design by Lieutenant Harness, R.E., showing by a great variety of shade, but without colour, the density of population in the different parts of the island." [2]

It is reasonable to suppose that Rawson's lengthy abstract for the Statistical Society would have had wide circulation, and that anyone working in the field of statistical maps would have come across it. Consequently it may be assumed that knowledge of the maps was probably widespread at the time, but except for the Memoir by T. B. Collinson, no other reference to the Harness maps appeared in print for almost a hundred years, in so far as I am aware.

In 1934 a symposium on population maps was held at a meeting of the Royal Geographical Society. At this meeting Professor Andrew C. O'Dell contributed some remarks in the course of which he commented upon the Harness population map and the printed account in the *Geographical Journal* reproduced a section of the map.[3] Professor O'Dell came across the Harness population map "purely by chance" while he was looking up the Second Report as a source in railway history.[4] Neither Captain Washington's report of 1838 nor Professor O'Dell's report of 1934 were indexed in the *Journal* in such a fashion as to show either the name Harness or his population map. The Library of the Royal Geographical Society has never contained any of Harness' works, so it is not surprising that they remained almost unknown for nearly a century. To Professor O'Dell, who stated that "the map is a pioneer of population mapping and a tribute to the ingenuity of the author," should belong the credit for bringing again to light this remarkable map. Although the map itself was subsequently buried there is reason to believe that its existence was neither immediately forgotten nor without effect in the decade or so following its publication.

The mid-nineteenth century population maps of Augustus Petermann.—To Augustus Petermann is usually given the credit for the establishment, in the geographical literature, of the techniques of many kinds of cartography, and there is no question that he richly deserves much of this. Nevertheless, a review of the population cartography of this period suggests that Petermann learned many of the techniques he employed while in England, and further, it is likely that the Harness map was either directly or indirectly the source of some of them. So far as can be ascertained Augustus Petermann made no population maps until after he arrived in London

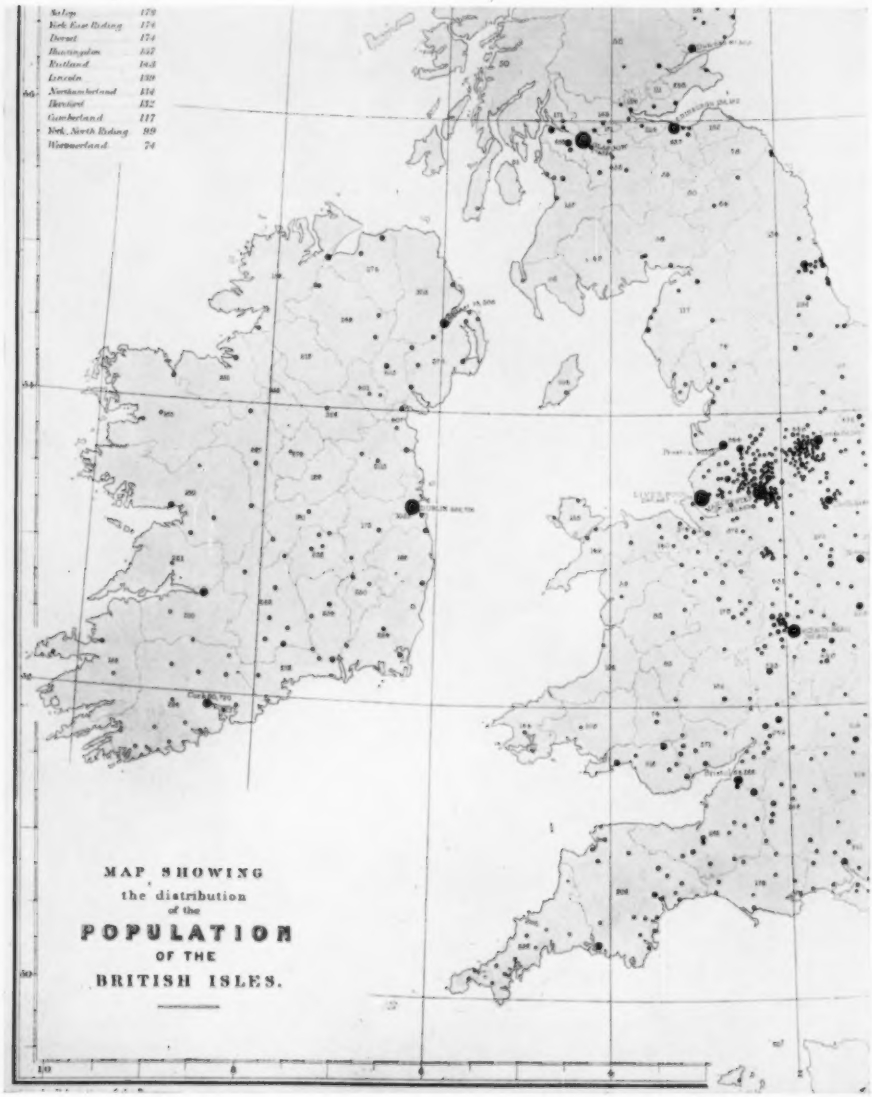
[1] Rawson, R. W. "Abstract of the Second Report of Irish Railway Commissioners," *J. R. statist. Soc.* **1** (1838) 257–77.

[2] Washington, Captain J. "A Sketch of the progress of Geography; . . . and of the Labours of the Royal Geographical Society during the year 1837–8," *Journal of the Royal Geographical Society*, **8** (1838) 237.

[3] Fawcett, C. B. *et. al.*, "Population Maps: A Discussion at the Afternoon Meeting of the Society on 17 December, 1934," *Geogr. J.* **85** (1935) 142–59, Map facing p. 144.

[4] Personal communication to the author.

Harness' Population Map, 1837. Original, 1 inch to 10 miles. Brit. Mus.



National Society's Map, 1851: designed by the Rev. Samuel Clark, drawn by Augustus Petermann. Brit. Mus.

from Edinburgh in 1847. His first population map was exhibited in 1848 [1] and was published in 1849 as one of Petermann's Maps of the British Empire.[2] It is an engraved map with shading similar to the Harness map, and likewise has the densities noted on the map in addition to the shading. This is apparently the second shaded map of density of population ever to be published.

The next map of population to come from the pen of Petermann (Plate 4) was one which showed population densities of counties only by means of numbers inserted therein and showed city populations by dots ". . . the size of which is as nearly as possible proportioned to the population." [3] The use of this technique of graduated circles for representing urban population on this map, and subsequent references to it, have resulted in Petermann's being erroneously credited with this innovation. In a footnote accompanying a later map of Spain on which he employed this technique, Petermann stated "All cities of the peninsula with over 5,000 inhabitants are indicated by black spots, the areal size of which corresponds as nearly as possible with the number of inhabitants." He points out the advantages of this technique ". . . which I first employed in the year 1851 . . . [on the National Society map.]" [4] Later authors have construed this to mean that Petermann stated that he originated the technique on the National Society map. For example, Max Eckert terms such representation of urban population as being in the *Petermannscher Manier*, and cites the above source as evidence.[5]

Petermann may have learned of the techniques of graduating circles of city populations and shading by density categories in a variety of ways, assuming of course that he did not independently devise them. He may have learned of the Railway Commission maps by way of Rawson who presented the abstract to the Statistical Society of London. It may be assumed that Rawson and Petermann were acquainted since they served together as committee members of Section F (Statistics) for the Nineteenth Meeting of the British Association for the Advancement of Science at Birmingham, 1849. In any case, Petermann knew of the Railway Commission's larger general map because he used it in revising the map of Ireland of the Stieler Hand Atlas.[6]

[1] Petermann, Augustus, "On the distribution of the population of Great Britain and Ireland; illustrated by maps and diagrams," *Report of the Eighteenth Meeting of the British Association for the Advancement of Science* (Statistical Section), London, 1849, p. 113.

[2] 'Map of the British Isles elucidating the distribution of the population based on the 1841 Census,' Compiled and drawn by Augustus Petermann. Scale 1/1,600,000, Published by Wm. S. Orr and Co., July 1849. In the British Museum.

[3] 'Map showing the distribution of the population of the British Isles,' Engraved by A. Petermann, 1851. Map VI, (b), in 'Maps illustrative of the physical, political, and historical geography of the British Empire . . .,' London, Published by the National Society for the Education of the Poor in England and Wales, London (probably 1852). The maps were also issued separately.

[4] Footnote 1 (by Petermann) in T. E. Gumprecht, "Die Städte Bevolkerung von Spanien," *Petermanns geogr. Mitt.*, **2** (1856) 393. Author's translation.

[5] Eckert, Max, 'Die Kartenwissenschaft,' Vol. 2, *op. cit.*, p. 156. It is clearly possible that Petermann may not have been averse to allowing the reader to infer that he was the first to use (on maps) the technique of the graduated circle (or *Schwarze Punkte*). The phrase he used ". . . *die ich zuerst im Jahre* 1851 . . . *angewandt habe* . . ." is ambiguous. But the chances are that if Petermann had wished to state that he originated the technique he would have italicized the *ich* or phrased it another way. Such an obvious ambiguity would not, it seems certain, have escaped him. In any case the credit for the innovation belongs, as far as I can determine, to Henry Drury Harness.

[6] Petermann, Augustus, "Neue Karte von Ireland, im Masstabe 1/1,150,000," *Petermanns geogr. Mitt.* **8** (1862) 182.

Whether or not the techniques used on the Harness maps were carried forward by Petermann and others in no way detracts from the fact that the Harness maps, in the light of our present knowledge, stand as the first on which appeared a number of techniques. The list is impressive:

(1) Graduated circles for city population.
(2) Urban and rural populations on the same map.
(3) Density of population (persons per square mile).
(4) Flow lines to show movement.
(5) The dasymetric technique.

It is not often that so many innovations have been presented simultaneously. It is, of course, entirely possible that other and earlier such maps have been similarly buried in government reports, but it is not likely that they attain the cartographic stature of the Harness maps.

ON THE ECONOMIC ORGANIZATION OF EASTERN EUROPE

A. A. L. CAESAR

INABILITY TO READ Russian or the languages of Eastern Europe is a severe handicap in making any analysis of the U.S.S.R. and associated European states, and the geographer is necessarily dependent upon such information as is available in translations. But the amount of such information on post-war developments is now considerable, though much of it is in the form of isolated reports and short statements of policy. There have been a number of searching economic analyses since the war, concerned mainly with economic development plans and prospects in Eastern Europe and with international trade, but there has been very little geographical analysis. One main feature of such an analysis will be the spatial patterns of economic activity, and it is with such patterns that this paper is concerned—patterns on the largest scale. It presents no new facts on the U.S.S.R. or Eastern Europe, but it suggests that an overall pattern of economic activity may be discerned, and that the pattern evolved in the U.S.S.R. has been reproduced in Eastern Europe. It asks to be read with an economic atlas.

THE U.S.S.R.

Prior to 1914 Russia had a typically "colonial economy." She was a primary producer exploiting the most easily accessible resources, and in international trade was dependent upon the sale of such primary produce. Capital resources were small in relation to area or population and much development was dependent upon foreign loans, the interest being paid in primary produce. Extensive rather than intensive development was characteristic, especially in agriculture, which was of overwhelming importance in the economic structure of the country, though there had been the growth in immediate pre-war years of a peasant proprietorship—particularly in the Ukraine. Internally Russia was characterized by very backward technological development, low economic and cultural standards, a mass population, mostly on the land and living at little above subsistence levels, inadequate transport facilities and a general geographical and industrial inertia. A grim picture!—but one to which the prime geographical factors, world position and size, had made a considerable contribution.

The First World War and the civil war added greatly to Russia's economic problems, and there was a long period of adjustment to new conditions. It was not until 1928 that the main lines of Soviet economic policy and organization of future development of the country became clear with the beginnings of the First Five Year Plan. The plan represented the first stage in an all-out attempt to make Russia independent of all other countries in heavy industry; to do in two or three five-year-plans what had taken half a century or more in Western Europe or North America. It had three main aims, the rapid development of heavy industry, the collectivization of agriculture, and cultural advancement. In industry the emphasis was on the extractive industries—especially coal and oil—iron and steel, non-ferrous metals, chemicals (including fertilizers), the machine tool industries and heavy engineering. An intensification and mechanization of agriculture was a necessary corollary. The

huge industrial developments planned would require the movement of large numbers of workers from agriculture to factory industry, from the land to the new towns. But the same number of people, or more, would have to be fed, and by a smaller farming population—hence the tractor plant priority in engineering developments. In the distribution of industrial activity, the First Five Year Plan concentrated mainly upon the larger of the existing industrial areas, especially the Donbas and the Moscow area, but there were the beginnings of new developments in the Urals and the Kuzbas.

The First Five Year Plan was successful, but not entirely so, and there were some changes in emphasis in the Second Five Year Plan of 1933. The agricultural system was modified to stimulate production by the introduction of "modified collectivism," and much emphasis was placed on improved transport and power facilities. The plan also provided for a more widespread development of heavy industries, a more intense development of natural resources and the beginnings of a measure of regional self-sufficiency. It showed an increasing appreciation of the geography of the U.S.S.R., which could not be welded into one integrated economic unit on the basis of land transport, to which there was no alternative. Hence the progressive development of large regional units, each with a heavy industrial core—the Ukraine and the Donbas, central European Russia and the Moscow Basin, the Mid-Volga valley and the Ural industrial area, western Siberia and the Kuzbas. The second plan also concentrated upon the building up of the Ural and Kuzbas industrial areas, as the first plan had upon the Donbas and Moscow areas.

But some parts of the U.S.S.R. had to serve the whole country. Trans-Caucasia and the Central Asian republics, for obvious climatic reasons, could produce foods and industrial crops which could not be grown elsewhere in the country. The implications of this fact are well demonstrated by the Soviet cotton policy. The acreage of cotton in Uzbekistan had increased fairly rapidly in Czarist days, largely in response to the demands of mills in European Russia, but the Soviet Government demanded a very large increase in this acreage at the expense of the cereal acreage, and promised to supply grains from the Volga area and western Siberia. This plan met with strong opposition in Uzbekistan, including that of the republic's own Communist leaders, but the Central Government had its way.[1] It can be argued that if Russia needed more cotton this was one of the areas which would have to produce it, and, considering the U.S.S.R. as a whole, there is much to be said for concentrating upon the special advantages of these southern areas and supplying their grain from elsewhere. But the case also illustrates clearly the Russian colonial economic policy—for Russian Central Asia is colonial territory. It is a policy aimed at giving such a territory a definite function in the Soviet economy and so to deprive it of any possibility of becoming a comparatively self-contained state economically. The Soviet cotton policy, by decreasing the cereal-growing area of Uzbekistan, made that republic not only dependent upon the Russian cotton market for its livelihood but also dependent upon Russian grain supplies for its food. So was Uzbekistan bound, almost irrevocably, into the Soviet economy. It was not an isolated instance.

The Third Five Year Plan (1938) continued the policy of the earlier plans on a still more comprehensive basis. There was again emphasis upon heavy industry, transport, and power developments, the mechanization of agriculture and the more widespread use of resources. But major planning "regions" of the U.S.S.R. were now officially recognized and delimited by "Gosplan"—the state planning com-

[1] Kolarz, W., 'Russia and her colonies,' Philip, London, 1952, p. 276.

mission. Some of the federated republics or groups of republics formed suitable planning regions within their own boundaries. The Ukraine is the clearest single case, with the Donbas industrial core area. But the Russian S.F.S.R. makes up some two-thirds of the whole of the U.S.S.R. It was divided into eight regions for planning purposes—European North, North-west, Centre, Volga, North Caucasus and Crimea, West Siberia, Central Siberia and Far East.[1] So was the regional pattern established, and it was immediately confirmed by its adoption in the form of transport operating divisions of the U.S.S.R. The Third Five Year Plan also placed emphasis on the economic development of a particular region: this time the Far East. The completion of an iron and steel plant at Komsomolsk in the Amur Valley marked an important stage in the build up of the industrial core of this region and further rapid development was planned.

However, the third plan ran only part way and its effects were largely obscured by the profound effects of the war. All reports on Russia agree that devastation in the west was worse than anything in Western Europe. As a result of occupation there was a large-scale transfer of both population and plant from the west to the Urals and western Siberia and a further considerable expansion of heavy industry in these regions and of agriculture in western Siberia. The net effect was an eastward shift of the economic centre of gravity of the country.

It was therefore not surprising that the Fourth or "Stalin" Five Year Plan (1946) was concerned almost entirely with reconstruction, and showed little concentration of further new developments in any one region, but it did suggest a consolidation of the wartime shift of industry eastwards. The economic centre of gravity of the country is apparently to remain further east than in pre-war years. With it there was further emphasis on Siberian agriculture, particularly on the basis of the new frost-resisting wheats evolved during the war.

In 1951 Russia introduced the Fifth and current Five Year Plan, which spreads industrial development still wider. During the war there were developments in the coalfields of the Pechora Basin, and operations are to be intensified. The Pechora coal may eventually be linked with the iron ores of the Kola Peninsula and there may be new steel plants in the North. It appears then that what the first plan did for the Ukraine and the Moscow area, the second for the Mid-Volga and Western Siberia and the third for the Far East, the fifth plan will do for north European Russia. But this will be combined with accelerated development of the eastern territories.

Economic planning in the U.S.S.R. therefore shows two main features, a consistent policy and a pattern of large economic regions. The policy is that of industrialization at the fastest possible rate, with priorities for capital plant. The regions necessarily show varied characteristics, and some, such as the southern regions, have special functions, but they have certain common features. Each has, in being or planned, a heavy industrial core, usually based on a coalfield or a concentration of other mineral resources as in the Urals, and a wide supply area producing food, industrial crops and mineral raw materials. Within the area are smaller industrial cities or towns concerned with a wide range of industries and maintenance work, generally, but not invariably, of a lighter type. The distribution of resources throughout the U.S.S.R. is not such that each region can be completely self-sufficient in its raw material supplies, but each can be very largely so in the bulky commodities needed. Greater self-sufficiency in industrial products is evident as the range of products of each region widens. Again it cannot be complete, but a

[1] Schwartz, H., 'Russia's Soviet Economy,' Cape, London, 1951, p. 156.

greater degree of self-sufficiency has been an objective since the Second Five Year Plan. Such is the pattern with which that displayed in the organization of Eastern Europe may be compared.

POLAND

Before the war Poland mined coal, worked oil and had a variety of manufacturing industries. During the inter-war period she advanced rapidly in some economic fields but was still primarily an agricultural country and in international trade a primary producer. Large areas were not very fertile and agriculture was not highly mechanized. Most authorities agree that Poland had the largest problem of concealed rural unemployment in Europe. Peasant poverty restricted the demand for industrial goods and so restricted the economic development of the country. Further, at least in the eastern portions of the country, the transport system was undeveloped.

The war produced profound changes in the "bodily shift" of Poland which resulted from it, and radical changes in the social structure of the country. The population is now about 25 million,[1] some 7 million less than that of the pre-war population of the present territories. The area is much reduced, but agriculturally Poland may have gained. Industrial resources were greatly increased by the absorption of the German portions of the Silesian coalfield, deposits of cadmium, cobalt, gypsum and other minerals, and the buildings and plant of the Silesian industrial area. In addition Poland has exchanged the badly-served eastern area of pre-war for the dense and efficient transport network of the eastern part of pre-war Germany and the ports of Stettin and Danzig (now Szczecin and Gdańsk). At the end of the war, therefore, Poland had a resource base adequate for considerable industrial development and in 1947 introduced a Three Year Development Plan.

This plan was necessarily concerned largely with reconstruction, but that included reconstruction of the newly-acquired industrial areas. Industry was planned to make up a much larger and increasing proportion of national production. Coal production was scheduled for 80 million tons in 1949, and much of it was to be converted to metallurgical coke to supply expanding iron and steel and heavy engineering industries. In engineering priority was given to transport equipment of all kinds, and railways in particular, electricity generators and farming machinery. Electricity generating capacity was to expand considerably—both thermal-electric, and hydro-electric so far as limited resources would allow. Production of consumer goods was to increase in some cases, probably with the utilization of the newly acquired factory plant, but the planned expansion was very much less than that envisaged in coal, coke, iron and steel and heavy engineering products.

In 1950 Poland introduced a Six Year Plan—six years were probably chosen in order to bring future plans into phase with the Russian plans. It continued the policy of the reconstruction plan and placed great emphasis on heavy industry. Coal output is to increase to 100 million tons per annum by 1955 and steel output to 7·0 million tons in the same year. Engineering is to expand with steel production and again priority is given to transport and generating equipment. The rate of collectivizing and mechanizing farming was to be increased, the aim then being to include practically the whole of the farm land in collective farms by the end of 1955.

In the immediate post-war years the westward movement of resettled Poles was combined with inter-industrial transfer, but since 1950 there have been difficulties

[1] The Census of February 1946 recorded slightly less than 24 million.

in obtaining labour for new factories. Peasant opposition to collective farms has been marked and a food shortage in a country which normally has an agricultural surplus is a significant feature. Such problems have been very similar to those experienced in Russia and similar measures of inducement or direction have been taken. But industrialization proceeds. In mid-1951 Poland announced the completion of her first fully mechanized iron foundry and her first synthetic petrol plant, and in May 1953 the Government was pressing for the completion of the steel plant in the large new industrial town of Nowa Huta near Kraków. The main objective of Polish planning is clear—a great expansion of heavy industry. And the main concentration of industry will be in or near Silesia, on or near the coal and with the momentum of an existing industrial concentration.

CZECHOSLOVAKIA

Pre-war Czechoslovakia was a land of contrasts, but Bohemia, lying on the watershed of Central Europe, came within the German economic orbit and was for decades the industrial core of the Austro-Hungarian empire. Industries included a wide range of capital and consumer goods industries and were technically well advanced—particularly in steel and heavy engineering in which the Skoda works was world famous. Yet, despite the importance of industry, agriculture still made up a high proportion of the national production. Between the wars, Czechoslovakia had developed her trade links with Western Europe and overseas countries—exporting mainly manufactures and importing grain, especially from Canada, and raw materials.

The effects of the war upon the economy were probably less in Czechoslovakia than in any other Central European country. There was no great war damage and the Germans built up industries in Bohemia as the bombing of Germany increased in intensity. At the end of the war, Czechoslovakia was not presented with the Polish problem of a complete change in the national economy, but she was faced with a serious marketing problem. Loss of her German markets, disruption of trading links with Western Europe and overseas and world shortages of grain and raw materials, placed her in a sort of trading vacuum. Czechoslovakia looked east for grain and Russia seized her chance. Payment for grains would be in manufactures, but Russia and south-east Europe wanted capital goods, not consumer goods. The trading position alone therefore demanded a higher proportion of capital goods in industrial production, and that change was already evident in the short (two year) reconstruction plan which began in 1947.

In 1949 Czechoslovakia introduced her First Five Year Plan. In it the emphasis on metallurgy and heavy engineering was much more marked. An overall increase in output of more than 200 per cent. as compared with 1937 was scheduled, while consumer goods industries were to expand only slightly.[1] Expansion was to be much greater in heavy engineering than in steel, which implies the use of a much higher proportion of the steel output in the manufacture of machinery than in pre-war years. Coal production was to increase by some 60 per cent., though the resources of Czechoslovakia are relatively limited. Of the planned investment 41 per cent. was allocated to mining and manufactures and 16 per cent. to transport, while agriculture received only 8 per cent.[2] Government pressure on the expansion of the capital goods industries is evident from periodic announcements from Prague;

[1] U.N.D.E.A. 'Economic Survey of Europe in 1948.' Geneva, 1949, p. 205.
[2] *op. cit.*, p. 203.

at the end of 1952 it announced completion of 13 foundries, 20 heavy engineering plants, 8 chemical factories and 3 large power stations. Alongside industry, the plan provided for agricultural collectivism through the preliminary stage of "compulsory cooperation."

The plan provided for the building of a large new steel works at Moravska-Ostrava and the nature of the industrial expansion generally strongly suggests that much of it is on or near the Ostrava coalfield, while announcements of completed works have referred to the Moravian highlands. There was also an announcement in March 1952 of the completion of a new steel plant, with capacity of 1 million tons per annum, at Huko near Košice in Slovakia.

Since the Five Year Plan was introduced there have been difficulties in Czechoslovakia particularly with food shortages and labour, and "underproduction" has been admitted in a number of industries, including coal, and in a wide range of farm products. Many forms of incentive or compulsion, including a drastic currency reform, have been tried in attempts to increase output, but in September 1953 the Prime Minister announced that there would be a substantial cut in investment in heavy industry and increased investment in agriculture.[1] That statement was a clear admission that the planned rate of industrial development has been too great.

But the main objective of Czechoslovakian planning is evident. It is that of Polish planning—the maximum possible development of heavy industry. The main centre will be the Ostrava coalfield in Czech Silesia. It is also significant that on 11 June 1954 it was announced that the second Five Year Plan would begin in 1956; that will bring the Czechoslovakian plans into phase with the Russian plans.

HUNGARY

Hungary suffered very considerable disruption on the break-up of the Austro-Hungarian Empire. She lost her ports and became a land-locked power, was cut off politically from Bohemia and Lower Austria—the industrial part of the empire—lost valuable resources such as the minerals and timber of Transylvania, and inherited only a small part of what had been a coordinated transport system. Hungary's population was increasing fairly rapidly, but she was thrown back suddenly to a stage of dependence largely upon the agricultural resources of the Hungarian plain. Hungary also found it difficult to market farming produce in Western Europe, a circumstance which was to play into Germany's hands in tying the country economically by guaranteeing her markets. By the outbreak of the Second World War, Hungary had reached much the same stage of development as had pre-war Poland—primarily an agricultural country but having some industry, including small steel and engineering industries.

Like Poland, Hungary suffered very considerable war damage, both by military action and by requisitioning, but unlike Poland the economy was not radically changed. Like Czechoslovakia, however, she was faced with trade problems on the loss of German markets and supplies.

At the end of the war, with Russian armies in Hungary, a Communist Government seized power and began an immediate policy of nationalization. A three year reconstruction plan was introduced in 1947 and the Government then turned to land reform. The reform was drastic—in some cases farms of less than 100 acres were seized for reapportionment. Such action may possibly have been socially justifiable, but, being combined with a policy of compulsory cooperation, it had

[1] See also U.N. 'Economic Bulletin for Europe.' 1953. Second Quarter, p. 8.

serious economic effects. There was a marked fall in agricultural output over and above that of the war.[1] A food shortage in the towns in Hungary provided Russia with a further opportunity which she was not slow to take. In industry problems were greatly accentuated by the heavy reparations due to Russia, Czechoslovakia and Yugoslavia, payable largely in industrial products, minerals and agricultural raw materials. The general aim of the reconstruction plan was a return to the 1938 levels of production, but with industry contributing slightly more to national production. On completion of the plan, the industrial level was to be 27 per cent. higher than in 1938, while agriculture was to reach 91 per cent. of the 1938 level.[2]

Hungary's First Five Year Plan began in 1950. There is again much emphasis on heavy industry but the proportion of the total investment allocated to agriculture (17 per cent.[3]) is much higher than in Poland and Czechoslovakia. There is to be a big expansion of irrigation and both an increased production of a wide range of crops and an increased proportion of industrial crops/food crops. The cotton acreage is to increase substantially. Further collectivization of farming and a rapid mechanization is envisaged. In heavy industry, both the scale of production and the range of products planned is much smaller than in Poland and Czechoslovakia. Steel output is to be nearly doubled, but it is the doubling of a small capacity, and the production at the end of the plan is to be at only 1·5 million tons/annum. There is to be no great increase in the output of pig iron and new steel works will be dependent upon scrap and imported pig. Bauxite and aluminium output is to be doubled, as is the electricity generating capacity, though that is clearly related to the aluminium plans and to steel production, as Hungary is not well endowed with fuels. Coal and lignite production is to increase to 18 million tons per annum, but may be insufficient for the country's needs. In engineering the largest proportional output will be in tractors and motor lorries, while in other industries large expansions are planned in the output of nitrogenous fertilizers and superphosphates. Both are obviously related to the plans for agriculture and much of the industrial expansion planned is in direct or indirect relation to farming needs.

Since the introduction of the plan Hungary has experienced the same sort of problems as Poland and Czechoslovakia, particularly in peasant opposition to the collective farms and in labour morale in industry, and similar methods of inducement or compulsion have been tried. But again such difficulties will influence the rate of economic development rather than the nature of the plans. Of newly-completed works the most important is the steel plant at Stalinvaros on the Danube about 35 miles south of Budapest. In revision of details of the plan, Hungary is to increase its specialization in light engineering,[4] which will make lower demands on steel.

Hungary's plans therefore differ from those of Poland and Czechoslovakia, but the difference is largely one of degree. Within industry there is the same concentration upon capital goods to the exclusion of consumer goods, but agriculture and the mining of ores is to be much more important in the national economy. Steel production and engineering is not planned on anything like the scale of Czechoslovakia and Poland—it probably could not be, the natural endowment of Hungary

[1] J.A.S. 'Hungary's Post-War Economic Difficulties." *World Today* Chatham House, 3, 4 (1947) 353.

[2] Seton-Watson, H. 'The East European Revolution.' Methuen, 1950, p. 244.

[3] U.N. Dept. of Economic Affairs. 'Economic Survey of Europe in 1948.' Geneva, 1949, p. 203.

[4] U.N.D.E.A. 'Economic Survey of Europe in 1951,' p. 61.

precludes it. On completion of the plan, the scale and nature of industry generally will in fact be very like that of some of the industrial areas of Russia away from the main concentrations of industry. But Hungary is also scheduled to be an important producer of raw materials, industrial crops and bauxite having pride of place, and the country should have a food surplus. The change was summed up by the government announcement at the commencement of the plan—the conversion of an "agrarian-industrial economy" to an "industrial-agrarian economy."

On future plans, and as a parallel with Czechoslovakia, it is significant that on 24 May 1954 it was announced that the next Five Year Plan would begin in 1956, 1955 being a year of preparation. The Hungarian plans will therefore be brought into phase with Russian plans.

THE BALKANS AND ROMANIA

Economically, as in other respects, the Balkans (for present purposes it is convenient to include Romania in "The Balkans") have been characterized by fragmentation since the break up of the Austro-Hungarian and Ottoman Empires. The economies of the Balkan states were very similar, primarily agricultural and carrying the burden of rural poverty. Collectively their mineral resources are considerable, but up to 1938 only the oil of Romania and Albania had been worked on any great scale. Industries were confined largely to agricultural processing industries, the refining of oil and the manufacture of some mineral concentrates. In general technical standards were low and there was over-population in relation to standards of production. Each country depended upon distant markets and the import of manufactured goods, and in pre-war years all were closely linked economically with Germany, which had advantages of geographical position over other industrial states.

The war effects were probably least in Bulgaria, which was by-passed by the Russian advance up the Danube, but Yugoslavia suffered destruction and disruption by initial invasion followed by continuous small-scale fighting. Romania received from both Germany and Russia treatment very similar to that given to Hungary and suffered considerable destruction and requisitioning. The advance of the Russian armies necessarily brought these countries within the Russian orbit, and all had difficulties after the war with the collapse of German markets and the cessation of supplies. In all cases Communist Governments seized power and reconstruction began with nationalization.

Yugoslavia launched a full-scale Five Year Plan in 1947 and until the break with the Cominform the economy of Albania was integrated with that of Yugoslavia. Subsequently Albania introduced a Two Year Plan for 1949–50. Bulgaria began with a Two Year Plan 1947–8 and Romania with a single year Plan for 1949. The short term plans were concerned largely with reconstruction and a return to 1938 levels of production, but Five Year Plans followed in Bulgaria in 1949 and in Romania in 1951.

The plans subscribe to the general character of Eastern European planning in laying emphasis on heavy industry, but more attention is given to the rural economy in general and to agriculture in particular. In all cases agricultural output is planned to exceed that of 1938 by some 50 per cent. and is to include a higher proportion of industrial crops, as in Bulgaria where the cotton acreage is to be doubled. All include provision for increasing agricultural land by new irrigation schemes, the drainage of marshes, flood control and the reclamation of marginal hill land.

Collective farms are required in all cases, though there have been changes in Yugoslavia since the break with the Cominform, and enforced changes elsewhere.

In industry Albania's plans are the simplest, as the very limited natural endowment would suggest. The main feature is the planned increase in mineral production, especially in oil, chrome ore and copper ore. A new hydro-electric power station is to be built and other industry is to be concerned largely with agricultural processing. Romania is to increase steel output to give twice that of 1938, but output will then be only 1·25 million tons per annum and the industry will be on a still smaller scale than in Hungary. Much of the steel will presumably be used in the tractor-building plant which is planned. There are contrasts in Bulgaria. Steel output in pre-war years was on a very small scale and no great increase is envisaged. The planned five-fold overall increase in engineering is to be largely in non-ferrous metallurgy, especially lead, zinc and copper. Apparently Bulgaria is planned as a producer of concentrates of these ores. Yugoslavia's plan provides for a much wider range of heavy industry. The output of the metal industries is to be seven times that of 1939, the expansion including aluminium, iron and steel—but steel output at three times pre-war will then be at only 760,000 tons per annum. Engineering products are to include much machinery not made in Yugoslavia before the war, from turbines to tractors. Output of all minerals is to increase, including coal, iron ore and oil from a field in Slovenia where only exploratory work was done pre-war. In all states, and especially Bulgaria, large expansions of fertilizer manufacture are planned and there is to be some expansion of processing industries.

The plans of all the Balkan states make provision for big increases in electricity capacity, employing water power and low grade fuels where possible, and the development of transport facilities. New roads and railways are to be built and much is made of improving navigation facilities on the Danube. The largest project is the Danube–Black Sea canal in Romania, but some reports suggest that work on it has been slowed down.[1] Both additional power and improved transport facilities are very necessary if production plans in mining and agriculture are to be realized.

Within the Balkans the administrative methods employed are the familiar ones of a Communist régime and they have met the usual opposition. In Yugoslavia economic difficulties were accentuated after the break with the Cominform by the need to re-orientate the economy, and by severe drought conditions. The Balkan plans therefore, despite the large proportion of investment allocated to industry, seem to be aimed primarily at substantial increases in production of minerals, concentrates, industrial crops and foodstuffs. Much of the industry, such as non-ferrous metallurgy, tractor building, fertilizer production and the provision of transport equipment, is related to these objectives. Yugoslavia is the exception: her plan is more general. Whereas the plans of Romania, Bulgaria and Albania somewhat resemble that of Hungary, Yugoslavia's is more like those of Poland and Czechoslovakia.

There are then marked contrasts in production plans between Poland and Czechoslovakia in the north, Hungary, Romania and the Balkans in the south. Poland and Czechoslovakia, on the completion of present plans, will together produce some 120 million tons of coal, 11 million tons of steel, and a wide range of engineering products—a major industrial concentration by any standards! In the south, production in heavy industries will still be in scattered and comparatively small-scale units.

[1] E.g. U.N. 'Economic Survey of Europe in 1953,' p. 66.

ECONOMIC LINKAGE OF THE U.S.S.R. AND EASTERN EUROPEAN STATES

In pre-war years, the Russian imports were restricted very largely to capital goods and a small range of essential raw materials which could not be produced within the country. Exports consisted mainly of foodstuffs and raw materials. As a result Russian pre-war trade with the Balkan countries was negligible and that with Poland and Czechoslovakia on no great scale. The swing over to trade with Russia in post-war years is shown by the 1946–7 returns. In that year Russia was concerned in over 50 per cent. of the trade of most of the Eastern European countries; in the case of Bulgarian imports, over 80 per cent. And in all cases, most of the remaining trade was between the Eastern European countries themselves.

Russia and Poland signed a number of trade agreements in the immediate post-war years (July 1945, April 1946, March 1947, August 1947). Provision was made for Polish export of coal, textiles and sugar for Russian raw materials, especially iron ore and cotton, petrol and grain. By 1948, Polish steel production was increasing and a further agreement (January 1948) was signed for a five-year period. It added Polish exports of steel and railway equipment for Russian tractors and motor vehicles. The commodities traded show the relationship to development plans, but the volume of trade is even more significant. The 1948 agreement provided for a 15 per cent. increase in volume as compared with 1947; 1949 trade (Agreement of January 1949) was to show an increase of 35 per cent. on 1948, and the 1950 agreement (June 1950) extended that increase to 1958. Such an increase in volume is almost certainly greater than the increase in production in Poland, dependence upon the Russian market is increased and Poland is bound into the Russian system. Poland has continued to trade with Western Europe, mainly for special requirements, but there have been breaks with the West,[1] and in October 1950 the Polish currency was revalued and tied to the rouble.

Russia had a comparatively small share in the trade of Czechoslovakia in 1946, but undoubtedly took advantage of the food shortage in Czechoslovakia. A trade agreement was signed in April 1946 by which Russia supplied grain in return for Czechoslovakian machinery and chemicals. But in Russian development plans Czechoslovakian industry had great value. In July 1947 invitations were issued to all European States to attend a conference in Paris to discuss the Marshall Plan offer. Czechoslovakia accepted the invitation promptly, but participation might have brought close economic links with Western Europe, and the leaders of the Czechoslovakian government were summoned to Moscow. Czechoslovakia withdrew acceptance immediately and on July 12 a five-year trade agreement was signed between Russia and Czechoslovakia. This agreement made provision for the exchange of Czechoslovakian machinery, machine tools, railway equipment, chemicals and textiles for Russian grain, cotton and other raw materials. The volume of trade was to be such as to use a very high proportion of the capacity of Czechoslovakian heavy industry. Since 1947 there have been further agreements [2] as production in Czechoslovakia has increased, a number of them making provision for substantial increases in the volume of trade—as with Poland, increases which are almost certainly greater than the increase in production. The agreement of November 1950 was for five years, and at 50 per cent. more than the average level 1948–50.

[1] Poland withdrew from the International Bank in March 1950 and from U.N.E.S.C.O. in December 1952.

[2] December 1947, October and December 1948, February and November 1949, February and November 1950, April 1952.

So was Czechoslovakia tied into the Russian system, the Czechoslovakian economy having a special function. The tactics used were very similar to those used at an earlier time in Uzbekistan; what cotton had done for Uzbekistan, steel and heavy engineering could do for Czechoslovakia. It was a well-tried method and had been successful.

In trade with Hungary, Russia again took advantage of the food shortage and agreements of 1946 made provision for the Russian supply of grain. In July 1947 a trade treaty agreed the exchange of Hungarian railway equipment, oil and oil products, fodder crops and cement for Russian iron ore and pig iron, coal, cotton and non-ferrous metals. In the following year (October 1948) a trebling of trade was agreed, and further treaties have increased the range of commodities—that of January 1952 provided for the Hungarian export of bauxite and aluminium.

But in Russian trading with both Hungary and Romania the Russo-Hungarian and Russo-Romanian Trading Corporations are a very important feature.[1] Hungary and Romania were active enemies of Russia and therefore had very heavy reparations imposed upon them. The trading corporations were set up to "facilitate payment," and the Russian material contribution to them consists of German-owned or German-used plant seized under the Russian interpretation of the Potsdam agreements. The nature of the corporations is such as to amount to joint control of Hungary and Romania by Russia and the government of the country concerned. That, combined with nationalization of industry and land, gives Russia firm control. The Sovrom (Russo-Romanian) companies are concerned with the production of oil, coal, and metal ores, and with transport (including Danube shipping) and banking, while bauxite production is included in Hungary. These interests confirm the emphasis of the development plans upon raw materials production and the improvement of transport facilities. With the establishment of the Corporations, reparations were substantially reduced; they were no longer necessary. Hungary and Romania are therefore very closely linked to Russia. Very different tactics from those used in Poland and Czechoslovakia were employed, but the same results were achieved.

The first post-war trade agreement between Romania and Russia (September 1945) followed the establishment of the Trading Corporation and the reduction of reparations payments. It provided for a Russian loan of food which was to be returned in kind within four years. Since 1945, Romanian supplies to Russia have been mainly through the Trading Corporation and consist largely of minerals and agricultural raw materials, but a later agreement (February 1950) provided for a 30 per cent. increase in volume. In March 1948 a five-year agreement was signed between Russia and Bulgaria for the exchange of Russian manufactures and cotton for Bulgarian tobacco and ores. It was extended in January 1949, in which year trade was to be 20 per cent. up on 1948, and listed Russian steel, tractors and cars, petroleum and cotton for Bulgarian tobacco, lead, zinc and copper ores, and cement. Again later agreements made provision for further increases in volume.[2] Yugoslavia and Russia came to an agreement in July 1947 for the exchange of Yugoslav lead, copper, pyrites, tobacco and agricultural produce for Russian coal, oil, tractors and motor vehicles, cotton and fertilizers. After Yugoslavia's break with the Cominform in June 1948 and the imposition of economic sanctions by Russia, the volume of trade fell to very small proportions, but Yugoslavia's exports then consisted almost entirely of mineral ores. Both the trade treaty and the

[1] There have also been some joint Soviet-Bulgarian companies operating in Bulgaria.

[2] Twenty per cent. in February 1950.

exceptions to the sanctions provide a clear indication of what Russia required of Yugoslavia.

Russia's imports from the Eastern European states therefore consist essentially of coal, steel, machinery and tools from Poland and Czechoslovakia, minerals, metals and agricultural raw materials and foodstuffs from Romania and the Balkans. Hungary supplies both machinery and raw materials, especially the bauxite. In return Russia sends raw materials and foodstuffs to Poland and Czechoslovakia, raw materials and manufactures, especially tractors and vehicles, to Romania and the Balkans. These movements of commodities confirm the contrasting functions of the two groups of states which the economic development plans suggest. It is also probable that there are some triangular deals, or that Russia buys in one satellite to supply another, thus ensuring control of movements. But it is evident that the whole area is being very tightly bound into the economy of the U.S.S.R.

But there is another important feature of these trade agreements. In one or other treaty with each of the Eastern European states provision was made for Russian advisers or technicians to be sent to aid in economic development. The implications are clear—Russian methods, uniformity, and further Russian control.

ECONOMIC LINKS BETWEEN THE EASTERN EUROPEAN STATES

Post-war trade agreements between Czechoslovakia and Poland began in August 1946 with the exchange of Czechoslovakian steel and machinery for Polish coal, zinc and electric power. Such an exchange is typical of movements within any large industrial area. Later agreements (April, June, August 1948) went much further. They provided for twenty years of cooperation in the joint development of the Silesian industrial area with some specialization in production for joint use of metallurgical and engineering products.[1] The industrial area was to become one unit! The agreements also covered the lease by Czechoslovakia of part of the port of Szczecin (Stettin) and the joint re-equipment of the port.[1] Joint construction of an Oder–Danube canal was also envisaged. Such a canal is no new idea, but joint planning emphasizes the need for improved transport facilities, and a canal suggests the movement of bulk low-grade freights characteristic of raw material supplies to a large industrial area. The run of the Danube in turn suggests that Hungary, Romania and the Balkans may well be the source area envisaged.

But an Oder–Danube canal has further significance. It may well be related to the reconstruction of Szczecin and, at the other end of the Danube, to the Romanian construction of a Danube–Black Sea ship canal. With the existing upper Volga–Gulf of Finland waterways and the completion of the Volga–Don Canal (May 1952), an Oder–Danube canal is the one missing link in what would be a complete circular system of waterways including the Baltic and Black Seas. Such a system would form a very effective link for heavy freights of the whole of the satellite area to Russia. But construction of such a canal is not an immediate project.

Czechoslovakian trade with Hungary and the Balkans is of a different character. Exports to Hungary (November 1948, April 1949) are machinery, manufactures and iron ore in exchange for minerals, including bauxite, and foodstuffs. Exports to Romania (September 1947, July 1948, May 1952) are made up largely of machinery—agricultural, wood-pulping plant, mining equipment and excavators—in return for oil, timber, agricultural raw materials and foodstuffs. To Bulgaria

[1] U.N.D.E.A. 'Economic Survey of Europe in 1948.' Geneva, 1949, p. 202.

(April 1948, April 1949, July 1951) goes agricultural machinery, railway and generating equipment for lead, hides, tobacco and vegetable oils. Supplies to Albania (February 1952) include mining equipment and generators for copper, asphalt and tobacco. The first agreement with Yugoslavia (July 1946) included machinery and mining equipment for Yugoslav copper, lead, chrome and agricultural products. Later negotiations were broken off when Yugoslavia broke with the Cominform. A number of the later treaties between Czechoslovakia and the Balkan States other than Yugoslavia, make provision for substantial increases in the volume of trade.

Polish trade agreements with Hungary and the Balkan States [1] are very similar to Czechoslovakia's, except that Poland is concerned more with the export of coal and coke than with machinery. As yet the Polish portion of the Silesian industrial area is the less developed in heavy engineering. Poland does export steel goods, mainly in the simpler forms, but no great amounts of machinery. With completion of Polish development plans, changes may be expected.

From all these trade treaties in which either Czechoslovakia or Poland participates a simple pattern emerges. Machinery of many kinds, steel, coal and coke, and manufactures moving out from Czechoslovakia and Poland for the development of agriculture, mining, forestry, transport, electricity and smaller scale industry in Romania and the Balkans; in return minerals, agricultural raw materials, timber and food. Such movements, like the trade with Russia, confirm the contrasting functions of the two groups of states which the economic development plans suggest.

Trade within the Balkan States, Romania and Hungary is unlikely to be so great as that between them and Czechoslovakia and Poland. Their economies are still very similar and they are not as yet planned to become major centres of industry. There have been many post-war agreements between states in this group,[2] but their content can be summarized in "mutual assistance" especially in the development of mining, agriculture and transport. A number of agreements make provision for improved navigation of the Danube. Hungary, as in her development plans, is in an intermediate category and has undertaken to supply machinery to Romania and Bulgaria. The Hungarian-Romanian agreement of June 1952 illustrates joint action—it provides for the connection of the high tension grids of the two countries.

But there was another important provision in some of the Balkan agreements, Yugoslavia and Albania created an economic union, while in the treaties between Yugoslavia and Bulgaria it was agreed to reduce frontier formalities to a minimum and to prepare for a customs union. Discussions on the Bulgarian-Romanian treaty of January 1948 may well have considered a similar move. Speeches [3] on the treaties went further and referred to cooperation so general that federation would be a mere formality, and to the decision being taken by Poland, Czechoslovakia, Hungary, Romania, Yugoslavia, Bulgaria, Albania and perhaps Greece (a comment on the times!). True, these statements were not wholly accepted by *Pravda* [4]—they

[1] With: Yugoslavia, March 1946; Hungary, November 1947, May 1948; Romania, February 1948, January 1949.

[2] Albania-Yugoslavia, July and December 1946; Bulgaria-Yugoslavia, August and November 1947; Bulgaria-Albania, December 1947 and October 1949; Hungary-Yugoslavia, December 1947; Romania-Yugoslavia, December 1947; Bulgaria-Romania, January 1948; Hungary-Romania, June 1948 and June 1952; Bulgaria-Hungary, July 1948 and February 1951.

[3] Tito in Sofia—Dimitrov in Bucharest. (Chatham House: 'Chronology of International Events and Documents,' 1947, p. 690; 1948, p. 56 and 101.)

[4] Chatham House: 'Chronology of International Events and Documents,' 1948, p. 100.

may have been too soon—and the agreements were brought to naught by the defection of Yugoslavia, but they may well indicate what was intended. Federation was a matter for all the states to decide, but, if federation would be a mere formality, it could only give expression to a state of affairs which already existed—the economic organization of the satellite area as one unit.

In January 1949 the establishment of Comecon (Council for Mutual Economic Assistance) was announced. Its object was stated to be the coordination of the economic relations of the Eastern European states. Was it more than the acknowledgment of the planning of Eastern Europe as one unit under Russian control? [1]

The break away from the Cominform by Yugoslavia is significant. Trade treaties signed before the break show that the main demands on Yugoslavia by Russia and the Eastern European states, especially Czechoslovakia and Poland, were for minerals and agricultural produce. To meet their needs, Yugoslavia's rôle should have been very like that of Bulgaria with emphasis on mining and non-ferrous metallurgy. But the Yugoslav plan was the exception among the Balkan development plans and provided for a much more balanced industrial development. After the break, Tito was reported as saying [2] that plans to industrialize the country "did not suit many states which had expected Yugoslavia to remain a source of raw materials for their industry." It is very probable that the real reason for the expulsion of Yugoslavia from the Cominform was the failure of her development plan to conform to the role allotted to her by a higher authority. At least it would be a more adequate reason than those contained in Russian accusations at the time.

CONCLUSIONS

The economic planning of Eastern Europe reproduces all the features of Russian economic planning. The rapid development of heavy industry is a requirement of all the plans but particularly those of Poland and Czechoslovakia, where Silesia is to become a major industrial area. Collective farming and an increased proportion of industrial farm products are common to all plans and have been imposed as ruthlessly as in Russia. The planned increases in minerals production reproduce the Russian plans. Large transfers of labour from the land to the towns, from farming to industry, are being made as they were in Russia and there is the same need to mechanize farming. Tractors and farming machinery have the same priority in either production plans or trade agreements which they had in earlier Russian plans. But Eastern Europe has also learned from the mistakes of the Russian plans and great emphasis is placed on transport and power developments from the start. The integration of heavy industry, showing a marked concentration in a small area, and supplies of minerals, industrial crops and foodstuffs from a very large area is evident in the development plans of the satellites viewed collectively, and in the trade agreements between Poland and Czechoslovakia on one hand, Hungary and the Balkans on the other. Economic development of a type and at a rate which would not be possible on the resource base of any one Eastern European state may well be possible on that of the whole area. But the loss of Yugoslavia is a serious blow as it was to be a main source of non-ferrous metals. There has been the same rejection of foreign aid, shortage of consumer goods and rationing of foodstuffs.

It can be argued that all this is a corollary of the adoption of the same methods of

[1] Comecon was established after the break with Yugoslavia, which was therefore excluded, but it is still indicative.

[2] "The Times" 28 December 1948.

planning in areas where somewhat similar physical and human circumstances obtain, but all the details of administration are faithfully reproduced. Similarity is in fact so great as to amount to identity, and thereby provides further evidence of a single centralized control.

Russia has greatly increased her economic strength, by expansion rather than by the absorption of a complementary economy. The policy of economic development in a series of large regional units has been extended to embrace the satellites as one additional unit. That unit takes the form of a heavy industrial area centred on Silesia and a wide supply area including Hungary, Romania and the Balkans. It is in fact a replica of the Donbas and the Ukraine, of the Urals and the Mid-Volga, of the Kuzbas and Western Siberia, and in it the Danube will play the part of the Dnieper or the Volga. What the First Russian Five Year Plan did for the Ukraine and the Moscow area, the second for the Mid-Volga and Western Siberia, and the Third for the Far East, and what the Fifth is doing for Northern European Russia, the planning of the satellites is to do for Eastern Europe. The Russian pattern has been reproduced.

Russia's policy in trading with the satellites is such as to link them irrevocably with her own economy. In creating that linkage a variety of tactics have been used but always with the same aim and within the framework of a consistent policy. In practice, the degree of economic autonomy enjoyed by the satellites is but little greater than that of the component republics of the U.S.S.R. Early mention of customs unions and federation may be but a prelude to an acknowledged economic and political union with Russia. Eastern European planning represents the geographical expansion of the Communist conception "Socialism in one state."

DISCUSSION

Afternoon Meeting, 21 February 1955

Before the paper the CHAIRMAN (Professor W. G. EAST) said: Mr. Caesar, Lecturer in Geography in the University of Cambridge, is to speak to us on what he has seen or found relating to the economic organization of Eastern Europe.

Mr. Caesar then read his paper

The CHAIRMAN: Although I doubt whether the main thesis which Mr. Caesar has brought before us can be controverted, I feel sure that some Fellows would wish to speak. I will first call upon Professor Buchanan, Professor of Geography at the London School of Economics.

Professor R. OGILVIE BUCHANAN: I claim no expertise on Russian methods or indeed on the geography of the U.S.S.R. or of Eastern Europe, but I would like to make one or two comments on what appear to me to be basic implications. I suppose the outstanding feature of the economic and political world of the last thirty odd years has been just this development of the U.S.S.R. and the new industrial revolution, a revolution marked by two significant—indeed decisive—differences from the industrial revolution of Western Europe. First, this new revolution has occurred in economic life after the arrival of efficient means of transport. It has been a revolution, therefore, that has not been hampered by the technical necessity of confining industrial development within narrowly defined and narrowly limited places. The other great difference is the concentration of the economic power in the hands of the political power. It is a political as well as an industrial revolution, and it is in a sense—but I think not a fundamental sense—an interdevelopment of politics and economics. I think not in a fundamental sense for this reason. We are accustomed in conditions of competition, perfect or imperfect, to think of production and trade taking place in

terms of costs and prices, and one is inclined at first sight to say, "If you have got an all-powerful political organization which decides to have the heavy industries in Western Siberia a thousand miles away from iron ore, there is no need to worry about cost; anything can be enforced by political control, backed up by force if necessary." But costs are just as important to the Soviet over-all direction as they are to Western countries, but they are costs in the sense that if you use resources in a particular way you are debarred from using them in any other way. If you decide to have heavy industries a thousand miles away from coal you can do it, but the transport, the raw material, the technical and administrative power are thereby diverted from other possible uses.

In fact, as we have seen, that has been quite deliberately done, and the uses from which these things have been diverted have been the consumer goods that would have provided higher standards of living for the people. On the other hand, you have got a functional collection of largely self-sufficing viable economic areas—a new kind of economic region—each of them providing something or other, sometimes a whole range of "somethings"—as a surplus available for transmission elsewhere.

This is a grandiose plan which has been carried through ruthlessly, and has advanced very far westward in the post-war years with the virtual incorporation of these Eastern European countries into the Russian system. The picture which the lecturer has drawn is clear beyond the possibility of doubt. Here is an area in which not merely are the complementary economic regions being tied in together, but in which also political direction is running side by side along lines which though they appear parallel, look like meeting together. That convergence is certainly a possibility.

There is here something more than the making of mere satellites to the U.S.S.R. I doubt whether it makes very much difference to the political and economic picture which way you look at it. Already Eastern Europe is functioning as much as a part of Russia as are the parts of the U.S.S.R. so-called. The main contribution, as I see it, that the lecturer has made lies in the method of examination, in the delimitation of these outstanding features, and in giving us a coherent picture which we may be able in due course to modify here and there in detail, but the broad lines of which, I am sure, will remain as he has painted them.

Professor K. C. EDWARDS (University of Nottingham): The first comment I would like to make is to emphasize how the lecturer showed the disadvantages of the system even in an area so diversified as the Russian. The antithesis of this situation is found in Yugoslavia in terms of food tendering from the West in exchange for metal ores and concentrates. Whatever the political motive, flexibility of trade relations was certainly a factor in the ultimate defection of Yugoslavia from the Cominform.

My second comment relates to his reference to and his clear illustrations of what he called the industrial cores, but he was careful in each case to name two such cores, and I think the expression of Soviet economic policy in terms of the land surface must be referred to in this double sense. In fact the illustrations he quoted bore this out—the separation of raw materials by great distances, and the need to assemble these materials and sources of power has led to a pattern on the landscape of a single axis of transport hundreds of miles long and the terminal industrial bases. Stalin himself in 1930 referred to these as industrial bases.

Dr. Moodie, more appropriately than I, might confirm the same industrial pattern now developed in Yugoslavia by means of communications connecting the steel plant at Zenica with a new port (Ploče, since 1949 called Kardeljevo) at the mouth of the river Naretva and the establishment of the power plant at this point. I suggest that this idea of industrial base is likely to become typical of most Eastern European countries as industrialization proceeds. It is a pattern rather different from the concentration we normally find in Western Europe and indeed in the older growth of textiles and engineering in the Moscow district. I wonder if Mr. Caesar can throw any light on the location of the latest steel plant in Eastern Germany, a mile or two from the Polish frontier? Either we have the normal economic factors operating in

the Soviet Union, or there must be something else at issue to determine the location of the steel works at that particular place.

Mr. T. McKITTERICK: There are two or three comments I wish to make, with great diffidence because all who study the economic geography and development of Eastern Europe work to a large extent in the dark. To take up a historical point: going back to the period immediately after the war, Mr. Caesar has suggested that the process of integration of Eastern European countries into the Soviet economic sphere began almost immediately and almost simultaneously. But there are at least two phases between which it is important to distinguish. There is a phase which lasted from the end of the actual fighting up to, perhaps, some time in the autumn of 1947 or the early part of 1948, and there is a second phase which began after that and which has continued. In the first phase a sharp distinction was made between ex-enemy countries—Hungary and Romania—on the one side and ex-allied countries —especially Czechoslovakia, Poland and Yugoslavia—on the other. From ex-enemy countries the desire for reparations was obvious. The setting up of these joint companies relieved the Soviet economy of some pressure. It enabled, for instance, the Soviet Union to import petroleum from Romania on extremely favourable terms by virtue of reparations, and to acquire control over those two countries, Romania and Hungary. The petroleum industry in Hungary had actually been developed by the Germans during the war, and the setting up of the joint companies in that country was a means of bringing that industry and other heavy industries under Russian control.

The other Eastern European countries were also forced to look towards Russia. They would have had to do it even if there had been no particular desire on the part of the Russians to gain political control in Eastern Europe. But it created great difficulty about payments. One finds, for instance, that the prices quoted in the agreements frequently were in terms of U.S. dollars. In some cases there was a sort of modified clearing arrangement for payment, but more frequently the question of payment was almost ignored and the prices quoted were purely nominal. At the same time some of the difficulty was got over by the Soviet Union exporting into Eastern Europe some raw materials, mostly cotton, and taking back from those countries manufactured cotton goods on rather harsh terms. By these means, by the end of 1947 or so, a fairly close set of links had been established, but I do not believe that up to that time there was any great evidence of an overall Russian plan for those areas.

The second phase began after the decision to reject the Marshall Plan. Czechoslovakia, not Communist at that time, wanted to come into the Plan. One or two of the other countries would have been glad to come in had they been allowed. Then there came the need to provide some sort of *quid pro quo*: having refused to allow them to come in on the Marshall Plan, another plan had to be substituted, and closer relationships were formed between Russia and the Eastern European countries and between the Eastern countries themselves. I myself still believe that this planning was a great deal less conscious than might appear at first sight. These are things that would, I believe, have happened to a large extent even without the desire for political domination. The Russian desire for political domination certainly intensified the trends, but it did not supply the origin of the trend towards integration. In conclusion, might I put one question to Mr. Caesar. We have heard very recently that the joint companies in Hungary have been dissolved. What has happened to the Russian capital engaged in those companies?

Mrs. J. A. STEERS: I congratulate Mr. Caesar on his venture into a very difficult area. Perhaps the greatest concrete asset of the Soviet Union has been the extent of the Trans-Siberian Railway. The railway itself was finished in 1904 and the railway in all-Russian territory was completed in 1917, actually in the year of the revolution. No one will really know what the Imperial authority hoped might eventually come from that railway, but one should credit the Tsarist Government with an appreciation of the fact that it would be a factor of unification, like the great railways of America.

Another point is this: the Russians inherited population movements in this part of Europe. For quite three generations before the Soviet Union came into being, the movement from Europe into the United States and South America had become one of the great trends in social and economic and political history. The cutting down of this movement after the first war presented a crisis in European demography. There must in any case therefore have been a violent readjustment of human effort because of the damming of the migratory instinct which was so strong. For the Soviet authorities it was an enormous asset.

My third comment is this. I should think it misleading to describe the eastward movement of industry as the effect of the second war. Enormous territory was lost by Russia in the first war, and one can visualize a strong and logical instinct towards a movement of production and settlement eastward right through the inter-war years. I think it is perhaps more correct to describe the movement eastward during and after the second war period as a jump forward in a policy already strongly established, largely on strategic grounds.

Dr. A. E. MOODIE: Someone lately spoke of a chink in the Iron Curtain; rather more than a chink has been opened this afternoon. I join issue with Mr. Caesar on one point. He used one word three times in his paper—the key word, "irrevocable." I do not think the situation in Eastern Europe is irrevocable. Something like this has happened four times—it happened under the Hapsburgs; it happened under the Germans (the general pattern was there, not the detail); and in the war years the *emigré* Poland, Czechoslovakia and Yugoslavia worked for years in this very locality at something very similar to what the Russians have put into practice. They had plans all drawn up for the unification of what the previous speaker has called Eastern Europe. Therefore, in view of the fact that there are at least three precedents for what is happening now, I would be very loth to accept the word "irrevocable" as a description of the situation.

Mr. G. R. JONES (University of Leeds): I should just like to put one question: whether or not Mr. Caesar will agree that the utilization of German resources in this Soviet orbit is having its influence. I refer to resources in personnel.

Mr. R. E. H. MELLOR: I have been interested in the German refugee problem in Western Germany. The German contribution to the industrial build-up in Central Europe was considerable before the war. How far the expulsion of Germans and German minorities from Silesia and Sudetenland has affected the situation, how far it has had a serious effect on industry is something we would like to learn. Has that been the main cause of labour shortage, particularly in the management and leadership of industry?

Mr. A. A. L. CAESAR: I have not time to do more than offer a few comments on some of the interesting points which have been raised. Professor Buchanan and Professor Edwards both raised the question of the development of industrial core areas and their linkage. I do not think that the development of long distance axes is very likely at any rate for heavy freights. When the Second Five Year Plan was introduced, there was a long distance shuttle service of coal against iron ore over some 1000 miles between the Kuzbas and the Urals, but this was one of the things which strained the railway system of the U.S.S.R. almost to the limit. One of the first priorities then was to find good ores much nearer to the Kuzbas, so making it largely independent of the Urals.

I cannot answer Professor Edwards' question on the location of steel works in Eastern Germany, but I should very much like to know the answer. Nor can I give a precise answer to Mr. McKitterick, but I do not think that we are at issue at all. I agree with what he said about absorption by Russia and also about the contrast between ex-enemy and ex-allied states, but I felt that if I emphasized different phases in the development of certain states it would obscure the relationship I wanted to bring out. When he says the reorientation in trade would have happened anyway I am only in partial agreement. It was probable, of course, that the Balkan States, being cut off from German industrial supplies, would have tended in any case to look to

Czechoslovakia and probably to Poland, but the change has been much greater than it would have been in that event. What has happened to the Russian capital? Would that I knew! Probably there are three stages: firstly, the period of reparations leading to joint companies, secondly the operation of the joint companies, and thirdly the economy virtually in union with that of Russia—and, seeing that there is complete nationalization in both Russia and its satellite, does it really matter?

In reply to Mrs. Steers, I agree the significance of the railways, particularly the Trans-Siberian, and I would add to that other lines aimed at getting the special resources of the southern areas to European Russia and Siberia. I would also agree with what she said about the progressive eastward shift. If I gave the impression that the eastward shift of the centre of gravity was a product of the war and the war only, that was not my intention. At the same time, the war undoubtedly gave a very considerable acceleration to this trend.

I must accept what Dr. Moodie said about the word "irrevocable." Nothing of a long-term nature can be irrevocable in political and economic life, but I do suggest that Russia is trying to make it so. I agree with Mr. Jones that the Russian use of German skill is having its influence, and, on Mr. Mellor's point, I think that the loss of the German contribution to industry had a very serious effect in some areas. The loss of the Germans in the Sudetenland weakened the position, but that was not peculiar to Czechoslovakia, it happened over quite a wide area.

The CHAIRMAN: Some of us, studying Russia in wartime, thought in 1945 that these new satellite countries were to become zones of political and economic penetration. We have now been told, after ten years have elapsed, what the situation is today. On a purely economic plane we can welcome these changes, but we have also to be aware of the diversion from consumer goods to capital goods production resulting in a fall in standards of living for the people. Mr. Caesar has put before us the pattern as he sees it of the integration between the Soviet Union and the European satellite countries, and the facts he has brought forward do bear out his interpretation of them. It is an interesting interpretation which calls for thought, because we are facing a new industrial revolution on a very great scale. Areas that before the war were tied to the West politically and economically are now tied to the East. It is a position that has to be accepted, and if not irrevocable, it may well last quite a long time.

On your behalf I thank Mr. Caesar for having given us such a stimulating lecture tonight.

THE PROBLEM OF TORS

DAVID L. LINTON

EVERYONE KNOWS THE tors of Dartmoor. They rise as conspicuous and often fantastic features from the long swelling skylines of the moor, and dominate its lonely spaces to an extent that seems out of proportion to their size. Approach one of them more closely and the shape that seemed large and sinister when silhouetted against the sunset sky is revealed as a bare rock mass, surmounted and surrounded by blocks and boulders; rarely will the whole thing be more than a score or so feet high. But if on closer examination the tor loses something of grandeur it loses nothing of its strangeness. Usually its main mass will be a solid rock outcrop as big as a house rising abruptly from the smooth and gentle slopes of a rounded summit or broadly convex ridge. The contrast between the gentle turf- or heather-covered slopes that lead up to the tor and the near-vertical bare rock walls of the tor itself is striking. The rock is usually traversed by bold and widely spaced near-vertical fissures, and these as well as the bounding walls are clearly the expression of joint planes in the granite. Powerful divisions also traverse the rock more or less horizontally—the so-called pseudo-bedding—and give the whole mass the rudely architectural aspect that is well described by the term "cyclopean masonry." The observer who permits himself to wonder by what giant hands these blocks were piled, however, will find his wonder increased when he observes how many of them have rounded and pillowy forms. Some tors closely simulate a great heap of piled woolsacks. Some comprise nothing more than a few rude ellipsoids of naked rock balanced one upon another; and in the extreme cases such stones have so small an area of contact with their supports that they will move under the hand. These are the "rocking-stones" or "logan stones" for which supernatural origin has often been invoked.

The origin of tors.—Even the most casual observer confronted with these strange assemblages of stones must ask himself by what means they have been shaped, and further, why they should occur where they do and not elsewhere. Geologists have also asked these questions, but being perhaps a little disinclined to pay overmuch attention to objects which are regarded with wonder and curiosity by the layman, have been too ready to assume that they know the answers. Tors are mentioned or illustrated in almost every British text-book of physical geology [1] as examples of the "weathering of granite," and it is explicitly or implicitly clear that the weathering in question is atmospheric. Holmes,[2] for example, in the caption to an illustration figuring Bowerman's Nose, speaks of "a Dartmoor tor . . . carved from well-jointed granite by rain and wind." But in no case known to me has the *modus operandi* of the weathering process been clearly described and shown to be adequate to produce the forms actually seen. For my own part, indeed, I find it very hard to see how atmospheric weathering—that is, the action of the elements on bare rock under the atmosphere—can produce tors or tor-like forms. In fact if we examine a few tors closely we shall find that present-day atmospheric weathering is acting upon them destructively and not constructively. Many tors are conspicuously in a state of collapse. The large rounded masses that in some cases are delicately poised are more commonly found dislodged and tumbled, wedged in fissures or lying at the foot of the tor. There are cases in which a whole rock-stack has fallen outwards

away from the main mass of the tor and lies, as it were, face down upon the turf. In yet others a joint-bounded slice of rock, standing at the head of a fairly steep slope, has apparently lost its foothold and collapsed backwards so that it now leans drunkenly against the rest of the tor. One gains a strong impression from such instances that however the tors were produced, exposure to the elements is highly destructive to their architecture. Moreover when we look at the individual pillows and woolsacks which are so characteristic of tors it is common to find them broken by frost along an almost plane surface. Sometimes the severed halves are only inches apart; sometimes they lie on opposite sides of the pedestal that bore the unbroken rock. The fracture plane appears as unrelated to the rounded form as the cut surface of a half potato to the rest of its shape: and just as knives were not in question when the potato was forming in the ground it seems evident that the component masses of tors were not exposed to frost action when they were receiving their rounded forms. Finally, when we look more minutely at the surface we find that since the rounded masses received their forms their more exposed portions have been notably modified by atmospheric weathering. They display, on their upper and windward portions, surface roughening and pitting with granular disintegration of the rock constituents leaving large crystals of quartz or felspar projecting as much as half an inch from the general surface. More striking still there may be groovings and flutings several inches in depth, as well as round basin-like hollows variously referred to as "pot-holes" or as "rock basins" (though neither term can be acceptable to geomorphologists since both have long been pre-empted for larger and more important features). The disposition of these grooves and hollows makes it clear that they are of later origin than the acquisition of the general rounded and pillowy forms. Some of the "pillows" which remain in place have been pitted and grooved on their exposed upper parts while their "underbellies" which have been sheltered from the elements remain smooth. Other blocks which are clearly fallen masses have developed flutings or "rock-basins" while in their new positions. There is in all this no evidence which suggests that atmospheric weathering acting on an exposed rock surface will produce from it a tor, but much to show that the weathering of the last few thousand years is in various ways modifying and destroying tors that were produced in some earlier time and by some other means.

These other means, however, must operate in a fashion similar to that in which geologists have supposed atmospheric weathering to act. They must act *in situ* and they must act selectively. The piled and delicately poised logans and rocking-stones cannot possibly have been transported to their present situations: they have been produced where they now stand by some form of wastage and removal of the surrounding solid rock. And since the shape and architectural character of the Dartmoor tors is clearly related to the arrangement of joints and pseudo-bedding planes in the granite, it follows that the wasting process has been guided and controlled by these internal division planes in the rock. The process most likely to act in this way is the sub-surface rotting of rock by acidulated ground water percolating along joints and from them into the body of the rock.

It is well known that in the humid tropics the downward percolation of ground water, acidified by its passage through the soil, leads to extensive rock decomposition, and further that embedded in the layer of decomposed material there may be detached masses of relatively sound rock. These have a rounded or ellipsoidal form and their production from quadrangular joint blocks has been indicated in standard texts [3] as the natural result of more effective penetration by the decom-

posing solutions where they work into the block from two sides (i.e. at an edge) rather than from one (in the middle of a plane face), and *a fortiori* at a corner as compared with an edge. Such residual masses have been well described, for example, by Scrivenor in his 'Geology of Malaya' [4] and called by him "core boulders." This term, especially in the form *core-stones* (which carries no implication of any limit of size either upward or downward) seems admirable for the purpose and will be so used in what follows.

Core-stones are not, however, confined to the tropics. Philippson mentions the production of round boulders (*rundliche Blöcke*) from cubical rock-masses and indicates how by the removal of the surrounding *Verwitterungsmulm* such boulders may be left strewn over the landscape as a *Blockmeer* or *Felsenmeer*, of which the granite areas of the Harz and Odenwald offer striking examples. De Martonne [5] speaks similarly of the granite country of the Sidobre, near Castres in the southernmost part of the Central Plateau; "les boules sur les sommets" he says "sont les parties qui ont résisté à la décomposition, isolées par entraînement de l'arène." His description is illustrated by photographs of slopes littered with great rounded core-stones laid bare "par le ruissellement," including a fine example of a perched boulder. Comparable forms are cited also from the granite mass of Huelgoat in Brittany and we are thus brought within a metaphorical stone's-throw of the tors of Devon and Cornwall. Moreover, the production of tor-like forms by the same processes that can produce core-stones had also been envisaged by Philippson who mentions "die bizarrsten, von Schluchten durchsetzten Felsformen" which he calls *Felsburgen*, and by Cotton [6] in New Zealand. Indeed, there appears to be an idea here which is of rather general application but has never been explicitly formulated—namely that tors, core-stones, and possibly other residual rock forms, *are the result of a two-stage process*, the earlier stage being a period of extensive sub-surface rock rotting whose pattern is controlled by structural considerations, and the later being a period of exhumation by removal of the fine-grained products of rock decay. It would seem desirable to formulate this hypothesis more precisely with the aid of diagrams (Figs. 1a and 1b).

Figure 1a represents a vertical section of some 20 or 30 feet of a "uniform" but massively jointed rock such as granite. Layers numbered from ground level downwards from 1 to 6 are separated by unevenly spaced pseudo-bedding planes. Columns lettered A to H are separated by unevenly spaced near-vertical joints. The rock is thus divided, or potentially divided, into a number of parallelopipedal blocks of very varying sizes. Some of these blocks, like those which would occupy the (un-numbered) spaces A_2, B_2, F_3, F_5 are relatively small, while others like C_5 and D_6 are large. Chemical weathering is assumed to result from the inter-granular penetration of the rock by groundwater moving down from the surface, inwards from joint-planes, and downwards, and to a small extent upwards, from pseudo-bedding planes. After a considerable lapse of time decomposition will have affected all the shaded portion. Some original joint-bounded blocks near the surface, or between closely-spaced joints, will be rotted throughout; others further from the surface or bounded by widely separated joints will be affected only by rounding at the edges and corners and some reduction in size.

In Figure 1b a radical change is presumed to have occurred. The finer-grained products of rock rotting have been removed—by a phase of active surface wasting following local rejuvenation of the rivers or by some other agency. Ground level has effectively been brought down to the base of the diagram. If the removal has been gradual, core-stones such as D_2, and D_3 will settle down on the supporting

composite pedestal D_4, D_5, D_6. Some stones such as C_1 and C_2 may come to rest in very delicately poised or precarious positions; others, like G_3, will topple and become chock-stones, or like H_4 will fall to the ground. The whole will have an architectural aspect deriving from the original joint pattern of the rock. The upper and outer parts will be rounded and well separated; the lower parts will approximate to joint-bounded blocks firmly rooted in bed rock.

Tors which conform in every essential to this model are very numerous—Hound Tor on Dartmoor may be cited as a typical example (Photos A and B). This is strong circumstantial evidence that they have been formed in the way that has just been described; but direct evidence is also available. At Two Bridges on Dartmoor a tor has been partly exhumed by quarrying (Photo C). The exposed portion is of the woolsack type, its form having been determined by pseudo-bedding planes at fairly close intervals and rather widely separated joints. The remainder of the tor is still surrounded and surmounted by the relatively fine-grained products of rock decay, the material known on Dartmoor as the "growan." The growan, though incoherent, preserves the structure of the granite with its lines of veining and has clearly been formed *in situ* with the residual mass of relatively unaltered rock within it. Instances of the same kind occur elsewhere. In a granite quarry at Cintra in Portugal a tor and core-stones have similarly been artificially exhumed by removal of the *saibro* (Portuguese equivalent of growan: Photo D), and I have noted numerous whale-back masses and core-stones partially exhumed by natural agencies in the Serra da Estrella, e.g. near S. Comba de Dao and north-east of Castello Branco. Again in a hollow at 3600 feet near the summit of Cairngorm in Scotland core-stones and rounded masses were exposed in 1954 by excavation and in one instance a vein in the solid rock could be traced continuously into its altered representative in the

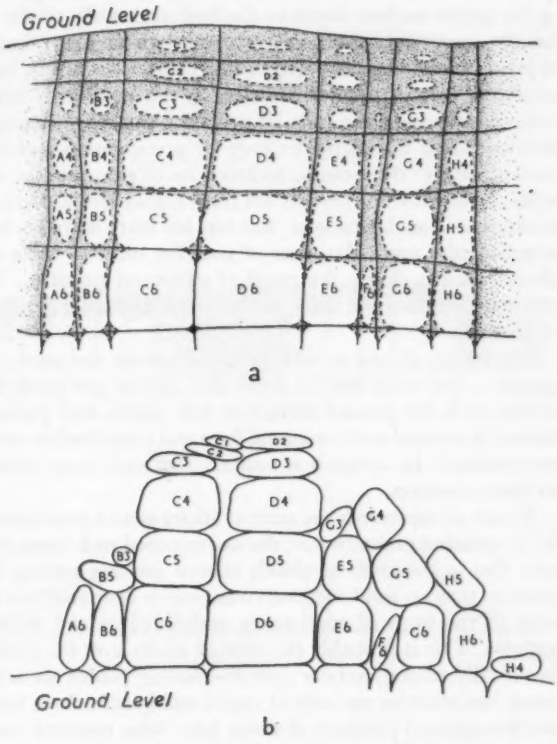


Fig. 1a and 1b. Stages in the evolution of a tor by sub-surface rock rotting

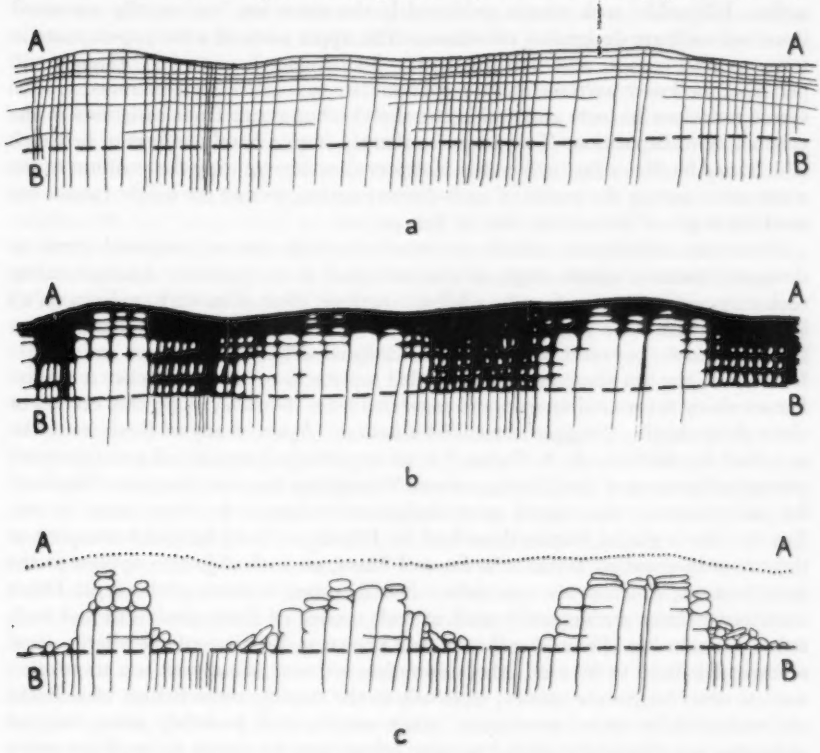
surrounding and overlying decomposed material. In the face of such evidence I think it must be conceded that tors resembling the model represented in Figure 1b may all be assumed to have had the two-stage history postulated for that case. Even when we concede this, however, we have only answered part of our question. It remains to be explained why the tors are located where they are.

The location of tors.—The tors of Dartmoor sometimes crown actual summits; just as commonly they rise from gentle slopes that lead to a summit; sometimes they are found at the break of slope above a valley-side; sometimes they occur at spur ends. In almost all cases there is an abrupt change from the flat turf platform or the gentle surface slopes to the bold rock walls of the tor itself. The latter are usually determined by master joints and where tors occur in groups a community of joint direction can be recognized. There have clearly been both topographic and structural factors at work in selecting the location of tors. Summits, ridge tops, valley brows and spur ends all provide situations where ground water is relatively deficient since it is supplied only by precipitation and rather freely removed by underdrainage: there can be no accession of groundwater, already well charged with acids, by down-slope percolation from higher levels. Rock rotting will therefore be minimized in such locations. But tors are more narrowly localized than this and the selection of a particular mass of rock for survival while neighbouring masses are decomposed is clearly the result of structural guidance. There is every indication that the main factor at work on Dartmoor and other granite outcrops is the spacing of joints.

Figures 2a, 2b and 2c will serve to illustrate the point. In Figure 2a a stretch of granite a few score feet in depth and 200 or 300 yards long is shown in vertical section with the ground surface at AA. Joints and planes of pseudo-bedding are shown by vertical and horizontal lines and considerable variations in their frequency are assumed. In nature it is unlikely that such large variations would be found in so short a section.

Figure 2b represents the state of affairs after a considerable period of rock rotting by percolating groundwater, the decomposed rock being shown in black. It will be seen that in the areas of closely spaced jointing rotting has in places been complete so that no solid rock survives, and is commonly so thorough that it survives only in the form of core-stones embedded in and isolated from each other by growan. This is probably the state of affairs over the greater part of the landscape, but locally where joints or pseudo-bedding planes are scanty rock decay has been much less effective and tors of varied architecture have been outlined. In Figure 2c the fine-grained products of decay have been removed and three striking tors have been exposed. Between them the ground may be, and commonly is, littered with core-stones. Further it will be noted that the three tors are shown rising abruptly from a solid rock platform. As has already been emphasized this is a common characteristic of tors—one of the most striking examples being the well-known Haytor (Photo E). This *basal platform* may be locally flat, but in a wider view is seen to undulate. Over an area of an acre or so it may be determined by pseudo-bedding planes as is suggested in Figures 2a, 2b and 2c, though it must be remembered that pseudo-bedding planes on Dartmoor and elsewhere are not necessarily flat as in the diagram but are commonly broadly convex to the sky in upland situations. It is evident that the surface BB in the diagrams has acted in some way as a downward limit to rock decay. It is not clear that any pseudo-bedding plane could act as a general limit in this way, and as suggested long ago by Cotton [7] the surface most likely to do so is the water-table. In areas of very tight joints the

water-table may be irregular, but where joints are numerous and well opened it will be a regular surface undulating in conformity with the topography of the time. Below its level the restricted circulation will inhibit chemical reactions since equilibrium concentrations of the soluble reaction products will soon be built up in the nearly stagnant ground water. This view seems both inherently probable and in conformity with the facts of observation. Tors on ridges and at spur ends commonly rise from inclined bases, the inclination being downslope and often quite marked. And the possible height of any tor is evidently predetermined



Figs. 2a, 2b and 2c. Stages in the evolution of a group of tors, illustrating the importance of joint spacing

by the available interval between the original surface AA and the water-table BB. It is in conformity with this that some of our highest tors—e.g. Vixen Tor which is 50 feet high on its uphill and 90 feet on its downhill side—are in spur end positions.

Thus far our discussion has been concerned with the questions of origin and location posed by the rock features of Dartmoor and the other granite masses of the south-west of England that are by common consent—both in geological writing and common usage—regarded as tors. Such features, however, are by no means confined to one type of rock or one part of the country, and as we move away from the type locality it may be necessary to consider forms and instances which vary

from the norm. There is obviously a danger here of including under the name "tor" features superficially similar, but in fact differing progressively more and more until at last we admit features which are not tors at all. Our definition must be genetic to be effective as a basis for classification. Using the hypothesis developed in our previous discussion we may therefore offer the following.

A *tor* is a residual mass of bedrock produced below the surface level by a phase of profound rock rotting effected by groundwater and guided by joint systems, followed by a phase of mechanical stripping of the incoherent products of chemical action. Ellipsoidal rock masses produced in the same way but entirely separated from bed-rock are designated *core-stones*. The upper parts of a tor approximate in form to core-stones, and like them may be completely detached, though still perched; the lower portions of a tor approximate to massive joint-bounded blocks. Great variations in form and architectural style thus result from variations in the original joint disposition. Tors may rise sharply from a *basal platform* of bed-rock which may be flat or inclined and is interpreted as representing the position of the water-table during the period of rock-decomposition, so that tor height cannot exceed the depth of the vadose zone of that period.

Since our definition is genetic we must also make use of empirical terms to designate features whose origin is undetermined or in question. An upstanding rock mass rising from a slope or a hill-top surface, clear of its surroundings on all sides, and with near vertical sides that may approximate to joint planes is best termed a *stack*. It would probably be so designated by rock-climbers and similar features on the sea shore are usually called sea-stacks or marine stacks. A similar feature rising from a valley side, and separated from the valley slope only on two or three sides should, I suggest, be called a *buttress*. Again, many of them would be so called by climbers. R. A. Pullan [8] in an unpublished account of some geomorphological features of the Pennines above Wharfedale has used the term "bastion" for such features: this would seem inadmissable since it has been used by von Engeln [9] for a glacial feature described by Flückiger [10] and has been accepted in this sense in standard texts.[11] As far as I know, no such objection applies to the term buttress, which in any case better describes most features of this type. Other descriptive terms are naturally used of rock masses of distinctive form and such terms are valuable. *Pedestal rocks* are well known in Britain and elsewhere; some of them I believe to be tors, others doubtless are not. *Whaleback* is a term often used to describe granite masses, especially in the tropics; some British whalebacks are undoubtedly *roches moutonnées*, some others, and probably many tropical examples, are genetically related to tors; others may be shown to be of yet other origins. Association of a rock-stack, buttress, pedestal rock or whaleback with an incompletely removed mantle of decomposed rock will of course demonstrate it to be a tor but the evidence of form, topographic relations or indirect association with core-stones or sapprolite may be adequate to justify ascription to the genetic category "tor."

Upstanding rock features that may be tors occur in Britain in fair abundance. In the south-west in addition to the undoubted tors of the granite outcrops there are tor-like masses of schorl rock at, for example, Roche in Cornwall [12] and Ausewell Rocks in Devon. Tor-like features occur on some of the doleritic outcrops of the Prescelly Hills and on flinty rhyolitic rocks at lower levels in Pembrokeshire. The Stiper Stones in Shropshire appear to be tors of Ordovician quartzite. Stacks and buttresses in association with core-stones and pedestal rocks are abundant in the gritstone moors of the Pennines in several areas and most that I have seen appear,

like the Prescelly masses, to be genetically tors. J. Palmer [13] has described stacks and buttresses in Corallian limestone in the Tabular Hills west of Scarborough for which he would suggest a different mode of origin, and R. A. Pullan [8] would prefer to interpret some of the Wharfedale features in a way that would put them outside the category of tors as I have defined it. In the Cheviot, R. Common [14] has noted granitic tors on Standrop Rigg and elsewhere and attributed them to multigelation. In the Ochils, Miss J. M. Soons has shown me outcrops of basic andesite on the summit of Bencleuch which, though small, have some of the characteristics of tors. Further north in Scotland tors are widespread and numerous. The Kincardine granite carries the striking tor of Clachnaben and the granite mass of Bennachie in Aberdeenshire carries a fine tor group. The summit of the Buck, just inside the Banffshire boundary, has a rough and broken tor-like mass developed in "schists" which have possibly been rendered tough and massive by thermal metamorphism. On the outcrop of the adjoining Cabrach intrusion of gabbroic rocks are numerous minor tor-like features, rather like the summit rocks of Bencleuch, and a good deal of evidence of former rock rotting in depth. The granite of Ben Rinnes carries a conspicuous tor group while on the granite of the Cairngorms tor development reaches impressive proportions. Several of the mountains carry large and numerous tors at altitudes well above 3000 feet, those of Ben Avon being the most numerous and the Barns of Bynack surely the most fantastic. Nor is this all. The sandstones and arkoses of the Old Red Sandstone give rise to striking tors on the summits of Morven, Smean and the Maiden Pap in Caithness, and in the extreme north of Scotland the syenitic summit of Ben Loyal is crowned with conspicuous tors. Although there are a few of these that I have not personally visited and a few more about which I have reservations, I am satisfied that the majority are genetically tors. They differ a great deal among themselves in form and characteristics and their full description must await a more comprehensive publication, but it seems to me already certain that tors are not a local peculiarity of the granite outcrops of the south-west of England, but a type of land form widely and significantly distributed through the country from extreme north to extreme south. Tors are developed from a considerable range of rock types, but it is clear that the Hercynian granites of south-west England, the Caledonian granites of Scotland, the felspathic gritstones of the Carboniferous series in the Pennines, and the arkoses of the Caithness Old Red Sandstone are the most noteworthy parent rocks. One may see in this a combination of apparently opposed characters that predisposes these rocks to tor formation. On the one hand the presence of felspar renders them all susceptible to chemical attack, while on the other the presence of a good deal of unweatherable quartz means that that attack is slow, and wherever joint-spacing is wide is so retarded that even after long periods of rock decay core-stones and tors remain unreduced. Tors are also formed in other siliceous rocks, the Stiper Stones quartzite, the Pembrokeshire rhyolites, and the Ben Loyal syenite, and on basic rocks, the gabbroic and doleritic intrusions of Banffshire and Prescelly, and appear to assume distinctive characteristics. They seem not to be formed in Britain, however, from any fine-grained or foliated rocks, an observation entirely consonant with the hypothesis of origin here advanced, though we may note that tors of schist certainly occur elsewhere.[15]

The age of the British tors.—Finally, the question arises—when were the British tors produced? This is a question which cannot be adequately answered without drawing on more detailed evidence than can be assembled here, but the general indications of that evidence can be outlined. The tors of glaciated regions such as

Scotland and the north of England pose the question of age in a particular form—what is the relation of the period of tor formation to the glacial episodes? Moreover we should speak, not of "the period of tor formation" but of the two phases of the process. We need to date first the lengthy period of rock rotting in relation to a stable water-table and base-level, and second, the nature and date of the change which led to the tors being exposed to view. Of these two problems the first is in some ways the easier to approach.

Profound rock rotting to depths equivalent to the heights of our larger tors would appear to require not only a great deal of time but probably also a warmer climate than we now enjoy anywhere in these islands. However that may be, it is certain that the decomposition of the rock that once surrounded the large tors of the Cairngorms could not have occurred under the virtually tundra climate of the Cairngorm summits today—a climate in which solifluction terraces and patterned ground are currently developed. Even during the climatic optimum these summits were 1000 feet or more above the tree line, and we may rule out the whole of post-glacial time, and *a fortiori* the whole period of the last glaciation, as the time when such deep decay occurred. The period of rock rotting cannot in fact be younger than the last inter-glacial. The same conclusion may be reached in a different way in other localities. Ben Loyal in Sutherlandshire bears on its higher parts between 2200 and 2500 feet several indubitable tors, but its ridges and spurs up to 1800 feet have been overrun by the last ice and bear plain *roche moutonnée* surfaces. It is clear that if post-glacial weathering has not destroyed the characteristic features of the *roche moutonnée* surfaces it cannot have converted any pre-existing forms above 2200 feet into tors. The deep rotting responsible for the latter must therefore be at latest inter-glacial.

In places where the mantle of rotted rock has not been swept away by glacial erosion it may be covered either by solifluction deposits, as appears to be the case in places on Dartmoor, in the Pennines and below Bennachie, or by indubitable glacial deposits as in the city of Aberdeen where T. C. Phemister and S. Simpson [16] have described up to 30 feet of thoroughly decomposed granitic rock with undisturbed veins overlain by several feet of morainic gravels or boulder clay with erratics of undecayed rock. Clearly the period of rock decay here antedates the local glacial deposits. Indeed, I conclude from the evidence at present available that everywhere in Britain the latest date that can be assigned to the period of profound rock decay is the last inter-glacial.

The possibility is not thereby excluded that the period of rock rotting was in fact much earlier, possibly late Tertiary. Workers in other countries [17] have associated tors with relatively old erosion surfaces: even Walther Penck is included here though he did not admit base-levelling and, so I think, misinterpreted his tors. And it is noteworthy that many of our most striking tors stand on upland surfaces that probably all British geomorphologists regard as having been shaped in pre-Pleistocene times. And if the present hypothesis of tor formation is accepted it is hard to imagine that the deep decomposition implied by the tors, and the long period of still-stand implied by the deep decomposition were not the products of the long period of still-stand implied by the past-mature form of the surfaces themselves. This possibility that the weathering implied by the upland tors is late Tertiary is attractive because of the known warmth of our Pliocene climate.

To admit such a possibility, however, is to emphasize the distinction between the two phases of tor formation; exhumation may be much later than the decomposition phase. The date of stripping is indeed very difficult to assess. Mention

has already been made of tors and core-stones that were still buried until they were artificially laid bare in quarries, while many examples could be cited where the process of exhumation appears to be currently in progress, but all would be on valley sides or below convex breaks of slope. Most upland tors on the other hand have been exposed to the elements long enough to be considerably affected by them, in some cases long enough for virtual destruction or collapse. Moreover the degree of weathering of individual stones of upland tors greatly exceeds that seen on stones of similar kind (in some cases almost certainly core-stones) used in megalithic monuments. The three to four millenia since the erection of those monuments is thus much too short a period to have affected this degree of weathering and it becomes likely that such tors have been exposed throughout post-glacial time. It may well be that the melt water from the ice and, more important, the snows, of the last glacial episode were the active agents in washing away the finer material and laying many tors bare. There is reason to think however that others have been exposed by solifluction, by the downhill flow of the whole layer of rotted material, embedded core-stones and all, when saturated with thaw water. In either case the last glacial episode appears to be the probable time of exhumation of many of our tors.

It will be clear that these views have implications regarding the glacial history of the areas in which tors are found. It is, for instance, hard to interpret the evidence of the tors and *roches moutonnées* on Ben Loyal except on the view that the summit of this mountain was a nunatak projecting above the surface of the ice of the last glaciation, though whether the nunatak area was still mantled by rotted rock or not is, to say the least of it, difficult to decide. But there is nothing inherently improbable in such an interpretation. Eilif Dahl's [18] suggestion that where mountains lie fairly close to the shore line of a warm-water sea the gradient of the ice surface will be high enough to permit some of the higher seaward mountain peaks to project as nunataks, may well be applicable here.

The evidence of the tors on the Cairngorms and in Aberdeenshire is more difficult to interpret. The generally held supposition that such an area as the Cairngorms must, because of its height and the rigour of its present climate, have been a centre of ice radiation in Pleistocene times, gives one pause before offering the suggestion made for Ben Loyal, that the area may have been a nunatak. Yet it is clear that since the deep rock rotting implied by the massive tors is at latest inter-glacial, the erosion accomplished by the last ice on these upland surfaces was negligible. The sections cited by Phemister and Simpson in Aberdeen remind us that the soft mantle of rotted rock is not necessarily removed by the passage of ice across it, though to be sure, the predominant results of ice action in the Aberdeen area were depositional rather than erosional. This, however, is not usually true of the ice over the uplands and it becomes doubtful if they could have witnessed any really active streaming of ice at this period. Indeed, as I have suggested elsewhere,[19] it seems necessary to regard parts of these uplands, with their tors and other topographic features which may be regarded as pre-glacial or inter-glacial survivals, as essentially unglaciated during the last Ice Age, though doubtless deeply covered by névé. Such a hypothesis obviously calls for detailed discussion of the evidence area by area. This is not appropriate here and we may perhaps conclude by noting the more general point conveyed in Figure 3. On that map the positions of more than a hundred known British tors are represented by about half that number of heavy black dots. On the same map the main centres of intense local glaciation are shown in solid black—North Wales, Cumbria, Galloway, the highlands of Argyll,

western Inverness and Wester Ross and the outlying centres of Arran, Mull and Skye. It will be seen that uplands with tors and uplands of intense glaciation are distributed in two complementary zones. The latter lie close to the western seaboard of our island from the Irish Sea to the Minch: the former are found in a broad zone to the east and south of this. Within this zone the distribution of tors is limited by the distribution of the outcrops of suitably constituted, massively jointed rocks. Particularly is this apparent in southern Scotland where the morphological features of the uplands strongly resemble those of the eastern Grampians, but tors are, as far as I know, unknown except on the Cheviot granite. Further, no tors are shown in lowland Britain although some may well exist,* so that the eastern limitation of the zone of tors may be more apparent than real. But the absence of tors from the western uplands is undoubted and it is hard to escape the conclusion that this is so because tors are part and parcel of an order of things which has been swept away from these areas by the heavy drubbing they received from the ice. Where tors are found they rise from hilltops and uplands of smooth and rounded aspect with forms and features that we associate with mature and past-mature development in the cycle of normal erosion. These landscapes can only be regarded

Fig. 3. The general distribution of the principal groups of British tors (see pp. 479–80)

* Mention has already been made of the Bridestones in north-east Yorkshire [13] which may prove to be valley-side tors; and it may be that some of the fantastic rock forms of the Tonbridge Wells sandstone outcrop in the Weald are also genetically tors, but they have yet to be examined.

as survivals from, in the local sense, pre-glacial times, some of them possibly from a period which is pre-glacial in any sense. Such landscapes, but for the Ice Age, would have been normal on suitably constituted rocks throughout upland Britain; today they are to be found only to the east and south of the heavy line drawn on Figure 3. That line marks the real western limit of the zone of tors and closely envelops the areas of intense glacial sculpture. It probably represents a climatic limit of Pleistocene times and it is striking how closely it corresponds with the generalized modern annual isohyet of about eighty inches.

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DISCUSSION

Afternoon Meeting, 9 May 1955

Before the paper the CHAIRMAN (Professor S. W. WOOLDRIDGE) said: I rise to introduce my old friend and co-worker, Professor Linton, who in the case of many of you needs no introduction. I will permit myself to say, having heard the substance of the paper delivered to the International Geographical Congress at Washington in 1952, that it was easily the outstanding paper out of many read at that meeting. I am glad that Professor Linton has had the opportunity to present a rather fuller exposition of the exceedingly interesting and significant views he has formed on this question of tors.

Professor Linton then read his paper.

The CHAIRMAN: After that careful piece of reasoning, based upon shrewd and critical observation, as Professor Hollingworth is here I will ask him to open the discussion.

Professor S. E. HOLLINGWORTH (University College): It was indicated in the introductory remarks to Professor Linton's paper that the problem of "tors" has largely been ignored by geomorphologists. The field of "process" in earth sculpture is common to geologists and geographers and much remains to be achieved, but I doubt the justice of the implied reproach of the former for past neglects. In this country geologists have, for example, largely pioneered the study of Pleistocene periglacial solifluction as a landscape moulding process. They would all welcome the striking growth of the study of process among British geographers both in the field, including excavation, and by laboratory study. Professor Linton's lucid and fascinating presentation of the tor problem is an outstanding example of careful analysis of field evidence.

Few students of land form would disagree with Professor Linton in his recognition of the two phases in the history of tor formation, especially in his application of it to granitic areas where deep chemical sub-soil weathering is so clearly demonstrable. As in the glaciated terrain such as North Wales and the Lake District the recognition of rounded pre-glacial upland, maturing in late Tertiary time, is the basis from which so much of our geomorphological reasoning springs. On one point in Professor Linton's thesis, I feel some reserve: I was not convinced that the downward limit to the second phase of tor formation, with its mechanical removal of the weathered material, was determined by the former water table, and so I am hesitant about the desirability of including this point in the formulation of a genetic definition. The water table in granite hills is subject to wide seasonal fluctuation and there appears to be inadequate evidence that the level of the base of the upstanding tors is related to the lower limit of advanced sub surface weathering. It would seem preferable to envisage that the lowering or mechanical stripping was a gradual process operating in a favourable environment, slowing down in its rate as a less weathered rock was approached, but was nevertheless a process which could be halted at any stage by a change of external conditions and so was a factor in producing a high or low tor rising from a smooth, gently inclined surface. In some cases the theoretical limit of "available relief" coinciding with the base of the weathered zone, might be reached.

I would like to ask Professor Linton whether in his studies of the tor problem he has found any evidence bearing on the relative rate of weathering of the granite under sub-surface attack as compared with the direct attack by surface agencies—rain, wind, etc.? In limestone terrain the development of deeply griked surfaces could largely be attributed to the more active solution of rock under vegetation than that which was bare and exposed to the direct action of rain only. Does Professor Linton think there is any significance in this analogy? Incidentally one of the finest examples of tor topography in the British Isles is the great piles of tabular masses of Old Red Sandstone conglomerate which form one summit of the Galtee Mountains in Southern

Eire. Their Pleistocene history makes it reasonable to consider that this summit was not overriden by ice and so the occurrence would fall into line with others described by the author. In the case of such upstanding masses as the Prescelly Hills, the limited extent of the weathering along the joints in the exposed rock masses would appear to weaken the case for regarding these crags as being formed by a process closely similar to that of tors of granitic and other rocks in which chemical and mechanical disintegration go hand in hand. I warmly welcome the paper and look forward to its publication as an important contribution to the scientific study of landscape.

Professor D. L. LINTON: I would like first to express my thanks to Professor Hollingworth for his appreciative and sympathetic reception of my paper. It is with considerable satisfaction that I learn that he feels there is good ground for accepting the two-stage hypothesis of tor formation that I chiefly wish to urge. It is by no means surprising that he should be less inclined to accept all the details of my interpretation. Regarding the feature which I have termed the *basal platform* I would point out that this is not an integral or essential part of my genetic definition of tors. In the latter I said only that "tors may rise sharply from a basal platform"—and the word I would like to emphasize now is "may." By no means all tors do. Only if the phase of rock rotting has locally proceeded to its downward limit, and only if the rotted material has been fairly comprehensively removed is a smooth basal platform likely to appear. I hope that more decisive field evidence bearing on this question may be found. In the case of the tors of the Prescelly region of Pembrokeshire—by no means all of which are on the Prescelly hills—it is fair to say that in some cases, e.g. the Maiden Castle built of Treffgarne rhyolites, rotting guided by joint planes has been so deep, even in a highly uniform and siliceous rock, as to produce masses of quite fantastic outline, and that there are instances where the products of rock rotting still remain *in situ*. As to the question of the relative rates of sub-surface rock rotting and "atmospheric weathering" my own observations are insufficient to lead me to any conclusion in the matter. The rock rotting which I believe to be responsible for our British tors may well have taken place under a climate warmer than we now enjoy, and there may have been available for it quite substantial periods of geological time. Finally I must thank Professor Hollingworth for drawing my attention to the tor topography of the Galtee Mountains: the relation of the tors on these summits to the corries that hold Lough Muskry and Lough Carra would certainly seem parallel to the relations observed between tors and corries on Lochnagar and in the Cairngorm Mountains.

Mr. W. V. LEWIS (Cambridge): I would like first to say how greatly I have enjoyed this lecture and even more being shown some of these features in the field by Professor Linton. I was inclined to think that he was overdoing the deep weathering process until he showed me deep weathering occurring in basalts in Tideswell Dale. Even if Professor Linton were wrong, and he certainly is not in the main, our gratitude is due to him for bringing before us so clearly important matters which we have neglected.

If I may try to be constructive and mildly critical, I do not like the lines drawn on the diagrams (Figs. 2a and 2b); the sequence of changes is unlikely to be represented as one line (BB), then a halt for deep weathering, a further halt for removal of the soil, and a revealing of the tors; yet another halt with the tors in the state in which we see them today, and so on. I think the process is more continuous. Whilst agreeing that the deep weathering occurs in warmer climates, as in Portugal, I think that in the colder areas, such as the Cairngorms, there is a wearing away of material around the larger blocks, which may form something like a tor, whether or not there is soil round the block. The large blocks on the tops of such hills are probably still being attacked today, when for half the year or more there is snow wrapped round the granite. Professor Linton showed an admirable instance of a circular hole which water had eroded in Millstone Grit, which is tough. If unacidulated, relatively innocent rainwater can corrode a hole in Millstone Grit, I really think that snow

resting against granite or some such massive rock, keeping the side of the tor soggy, will help surely though slowly to eat into it and steepen the sides.

Concerning the fact that tors occur on the summits of hills, this is simply due to the tendency of soil to creep down hill. True, tors will tend to occur where the rocks are most massive, but statistically we can say that hilltops, when not too flat, are favourite places, and I suspect that the down hill creep of material by solifluction or any process away from the top will tend to leave the summit area of the rock naked because no more soil is supplied to the summit area.

Professor LINTON: I agree that the diagrams perhaps suggest something more categorical than is actually the case. Nevertheless, I think that more than soil creep is involved in producing the difference between the blocks that remain as a tor and material that creeps away. Once a rock mass has become exposed it is not likely to be destroyed very rapidly by atmospheric weathering. Whereas the surrounding material is relatively rapidly attacked by sub-surface rotting, the tors once they are exposed have a good chance of a long life. Rainwater, as Mr. Lewis has suggested, can have some effect—in fact, may have; having recently found a hole 21 inches deep corroded in Pennine gritstone, I have a healthy respect for what acidulated water can do.

Mr. Lewis said he did not think I was wrong; but even if I am not right I hope I have rendered a valuable service. I cannot believe that all I have suggested is right; but I hope I have stimulated interest in the tor problem. It needs close examination and by as many workers as possible. I hope some of those present will work on it.

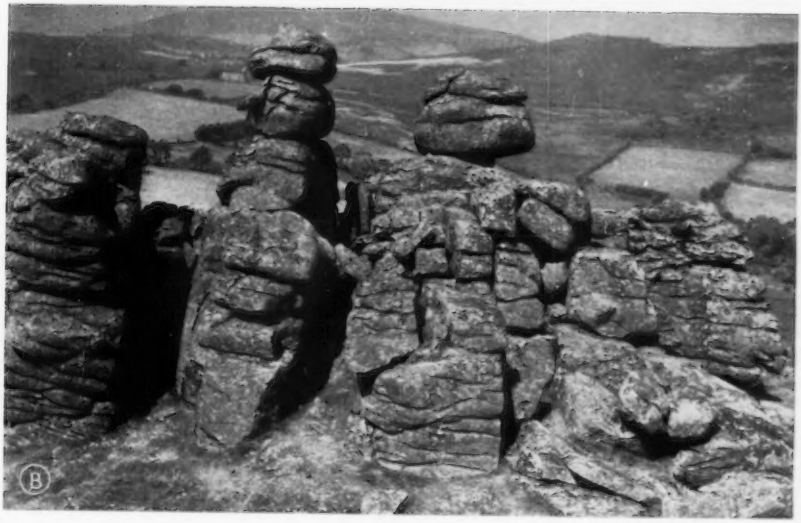
Mr. JOHN PALMER (University of Leeds): Professor Linton has kindly referred to my recent study on tor formation in N.E. Yorkshire, read to the Institute of British Geographers in January 1955, and has suggested that the features there discussed might be a special class of valley-side tor, and, if they originated in a manner other than that envisaged by Professor Linton for tors in general, that they should have a name other than tor. Some of the tors described by me occur *on* the watershed and have all the other appearances associated with tors When my study was made I did not have the advantage of Professor Linton's evidence, but was acquainted with the work of Crickmay (*J. Geol.*, **43** (1935) 745–58) which has some similarities. I am still unable to find that the evidence in N.E. Yorkshire allows the tors there to be explained by Professor Linton's theory.

At the same time, but with great diffidence since I do not know Dartmoor intimately, it has occurred to me that the tors there might be explained in a manner similar to that which I have favoured elsewhere. Many workers on Dartmoor have found that the rock in the tors is more resistant than the rock around them. The maps indicate that most of the tors occur around the upper edge of steep slopes, be they valley sides or steps between plateaux levels. Tors are absent over much of the plateaux surfaces, and I am led to wonder at this distribution. If at some time the rate of removal at the top of steep slopes was rapid, differential resistance to weathering might have allowed portions of the ground to emerge above the general level. Once emerged, the pseudo-bedding and joint structure would allow the detailed tor form to develop. The reason for the emergence might be related to changes consequent upon river rejuvenation, or perhaps climate change.

I should like to offer thanks to Professor Linton for this the first attempt to grapple seriously with the intriguing problem of tors on a national and rational scale, but would add my opinion that in view of the revolutionary morphological implications, a series of detailed studies to test the theory locally are clearly called for.

Mr. RONALD WATERS (University College of the South-West): I would like to refer to two characteristics of the Dartmoor tors to which Professor Linton has already directed our attention, namely, their structure and their alignment.

On Dartmoor, tor structure varies from massive to what the late Mr. Hansford Worth described as lamellar. Lamellar tors are tors in which vertical joints are relatively rare, but quasi-horizontal divisional planes are frequent; they are tors in



The problem of Tors (*titles on page 487*)

The problem of Tors (titles on page 487)

which the restriction of vertical jointing has led to the development of numerous closely spaced pseudo-bedding planes. Massive tors, on the other hand, exhibit better developed vertical jointing and fewer horizontal joints. The massive castellated tors are the more striking, often rising abruptly from the edge of a fairly level surface, Professor Linton's "basal platform"; moreover, their vertical extent is commonly greater than that of the lamellar variety. But the lamellar tor is found most frequently crowning a hillock or mound which rises above the general level of the surrounding surface; the surface slopes of the mound often conform almost exactly to the lie of the pseudo-bedding in the exposed rock mass.

These observations suggest that so far as tor formation is concerned there is an optimum spacing for the vertical joints. On the porphyritic granite of Dartmoor the horizontal dimension of the joint-bounded blocks building the biggest tors is approximately 300 square feet. This is the size of the largest joint blocks on Vixen Tor, the biggest Dartmoor tor which stands 54 feet high. The vertical extent of tors decreases with a decrease in the horizontal extent of their constituent blocks until the tor becomes no more than a group of low pinnacles barely breaking the surface of growan. An increase in the horizontal dimension of constituent blocks beyond the optimum is also accompanied by a decrease in the vertical extent of the tors as they become progressively more lamellar until once again they scarcely rise above the ground surface. In this extreme case the surface is, of course, developed on sound granite. In the double tor of Haytor Rocks these relations are well shown. The eastern, more massive and higher portion rises some 50 feet; its constituent blocks are comparable in size to those building Vixen Tor. The western portion exhibits fewer vertical joints, is consequently more lamellar, extends over a greater surface area and is lower.

There are on Dartmoor distinct rectilinear alignments of the tors and many other associated features owing their origin to differential etching. These alignments are, of course, valuable indicators of the structural grain of the country. They may or may not be parallel with valleys and divides; in fact, they can be used as a yardstick against which may be measured the amount of adjustment to structure attained by different elements of the drainage pattern. A field survey of the relations existing between the streams and structural grain of Dartmoor is now being made, and the promising results already obtained would seem to indicate that the significance of tors and related features for geomorphology may be very great when their space relations are considered in some detail.

Professor LINTON: I thank Mr. Palmer and Mr. Waters not only for what they have said but for their assurances that they are both working on the problem in the field. Mr. Palmer will perhaps seek more evidence for his view that the details of tor structure are fashioned after the tors have emerged. The suggestion I am putting forward tonight is that the tors are rock masses which were pre-selected before they were exhumed and is based on local studies in different parts of the country. Naturally, the process that leads to the pre-selection will be governed and controlled by structure and notably by the spacing of joints.

Dr. G. T. WARWICK (University of Birmingham): The many granite blocks littering the slopes below the Dartmoor tors are often concentrated into distinct lines along minor gullies and spread out on reaching flatter ground. This indicates a considerable reduction of the tors after exposure, and the present apparent lack of movement of the blocks leads me to suggest solifluction as the mechanism responsible for their transport to their present positions. On the Millstone Grit moorlands of the Middle Wharfe Valley, Mr. R. A. Pullan has demonstrated (in an unpublished M.SC. thesis) that tors are only common on those grits with a high felspar content.

In the southern part of the granitic section of the Odenwald, the hills are gently rounded like chalk downland, and there are no tors. Roadside exposures reveal at least 10 feet of extremely weathered rock, in which original banding, and in one case a small reversed fault, were clearly to be seen, indicating that there had been little subsurface creep here. This area was unglaciated, and may have preserved its vegetation

cover during the cold periods of the Pleistocene so that the unweathered blocks have not been exposed. In strong contrast, in the Trifels district on the western side of the Rift Valley, gigantic, bare "stacks" of siliceous Middle Bunter Sandstone rise some 150 feet abruptly from their gentler, forested basal slopes. This type of feature appears to be more closely related to the hypothesis of Walther Penck.

Professor J. A. STEERS: I know nothing directly about this subject, but Professor Linton's arguments seem very sound. While listening to his paper and looking at his slides, my thoughts took me to Queensland. At Cape Melville there are hills some hundreds of feet high and a few miles long composed almost entirely of great boulders. I do not know how they were formed, but if Professor Linton's arguments apply also to them, a great deal of rock has been removed in some way. Professor Linton has referred to Portugal: I hope he will extend his activities because I think he will find some admirable material for his purpose in the Tropics. I congratulate him on his paper.

Professor DUDLEY STAMP: I do not often venture into this field, but I am tempted to do so because only a few weeks ago I was observing with Professor Davis, Professor of Geography at Hong Kong, what is happening in that colony. In these days of land shortage there it is nothing for it to be decided to remove a hill of 300 feet high. They are granite hills, nominally, and the removal is done by Chinese contractors. If the contractor is lucky and the hill is of completely decomposed granite he makes a fortune; if he is unlucky he goes bankrupt. We found by measurement that the rotting of the granite goes down to at least 250 feet. It seemed that to use the word "weathering" when speaking of that sort of depth was wrong. We said we would refer to it as the "rotting" of granite, which does not presuppose whether it is atmospheric in origin or not.

I would ask Professor Linton if he would link up his studies in the south-west with another phenomenon of granite masses, china clay, and particularly with its origin, because there are those extraordinarily deep pits from which the china clay is extracted not very far away from the area of the tors. Professor Davis and I were wondering whether it is pneumatolysis at the lower levels which gives rise to the areas of rotting rather than atmospheric weathering from above. Does Professor Linton think there is any possibility of the same being true in the south-west?

Professor LINTON: That last suggestion has been considered by other geologists who found that there is no connection between pneumatolysis and the growan. Some of the china clay beds are 100 feet or more deep, but they are very sharply defined and clearly distinct from the areas in which rotting from above has given rise to the growan.

I am greatly indebted to Professor Steers and Dr. Stamp for their observations on occurrences of deep weathering and core-stones in the Tropics. And since I asked for a better definition, I accept Dr. Stamp's suggestion that rotting is undoubtedly the right word. I shall be glad to use it.

The CHAIRMAN: I know it will be the wish of all present that I should express on their behalf and my own also our cordial thanks to Professor Linton. I will not attempt to add further to the discussion but simply record my own satisfaction and conviction that Professor Linton is throwing a great deal of continuous light on this phenomenon. He has not only described in some particularity the origin of the tors but has thrown a great deal of light on their significance.

ILLUSTRATIONS

A. *General view of Hound Tor, Dartmoor, showing the abrupt rise of the tor from the gently convex surface of the moor and the influence of vertical joints and pseudo-bedding on its architecture.*

B. *Part of Hound Tor, Dartmoor, to be compared with Fig. 1b. Note the rounding of the upper masses, some of which are perched like D2 and D3, or wedged like G3 and G4, or fallen like H4. The lower blocks are conspicuously joint-bounded like C6 and D6, while wide joint-bounded fissures traverse the tor which correspond to vanished masses such as might have been numbered F1 to F5.*

C. *"Woolsack type" tor partly exhumed from the surrounding and overlaying growan by quarrying operations at Two Bridges, Dartmoor. In the architecture of this tor the pseudo-bedding dominates.*

D. *Well rounded core-stones of granite in place in decomposed rock* (saibro) *exposed by quarrying at Cintra, Portugal. The strong contrast between the sound rock and the rotted* saibro, *in which pick marks are clearly visible, should be noted. It is possible that if the exhumation were completed by careful hosing down a tor of perched rounded masses would be disclosed.*

E. *The north-eastern portion of Haytor Rocks, Dartmoor. This large and massive tor is evidently bounded towards the camera by a major joint-face, and rises very abruptly from the* basal platform *on which the sight-seers are standing. This platform is of rock which frequently shows through the thin turf.*

Photographs by the author

AGRICULTURE AND INDUSTRY IN BRAZIL

HILGARD O'REILLY STERNBERG

SINCE THE EARLY days of Portuguese settlement, Brazilian agricultural activity has been directed into two distinct channels of production, one providing goods for export, the other commodities for domestic consumption. These two branches of activity are controlled by quite different factors and, therefore, are apt to show widely diversified and independent trends. Nevertheless, there are certain general statements which, by and large, hold true for both categories. Thus, for example, the following features may be indicated as characteristic of Brazilian agriculture: (1) misuse of soil resources, resulting in widespread erosion and loss of fertility; (2) transient and intermittent use of farm land, involving long fallow periods or complete discontinuance of cultivation; (3) low output of land and labour; and (4) the superseding of several areas of traditional crop specialization, with the emergence of new—and more southerly—centres of production.

The farmed areas of Brazil illustrate the statement made by an eminent geographer to the effect that it is not the lands of old civilizations, but those of recent settlement which are the most worn-out parts of the world.[1] Land is cleared, cropped, exhausted and abandoned, while new forests are destroyed and their soil plundered. Even now, little over 2 per cent. of the country's surface is planted to crops,[2] a fact which favours the reassuring but false idea that the nation is still in possession of vast reserves of highly productive virgin soils. This supposition seems to be based on a double misapprehension: that all forest soils are necessarily fertile; and that a large part of the interior of Brazil is forest-covered. Evidence such as the disastrous decline in productivity observed in some upland soils of the Amazon valley, after the cutting and burning of the primeval forest, has somewhat shaken the belief that forest soils are necessarily fertile. And as the backlands of Brazil become better known, even the man in the street comes to recognize the extent of grassy plains, savannahs and scrub in the make-up of Brazil's plant cover. It is growing increasingly evident that the resource base has been grossly overestimated in so far as the potentialities of soils are concerned. Only relatively small areas where basic lavas crop out, or recent alluvium has been deposited, measure up to the popular conception of the potential fertility of what, not infrequently, has been considered the future bread-basket of the world.

As the pioneers slash and burn their way through lands of high native fertility, the belt of agricultural production is pushed further and further from the markets. Many improvements are abandoned and the depleted lands are usually given over to extensive grazing, while the settlement of new areas obviously exacts new investments in the form, for instance, of public utilities. All this tends to increase cost of production. Furthermore, agricultural commodities must be hauled for longer distances and are burdened with ever-increasing costs of transport. As the railroads thrust forward with the advancing pioneer fringe, production declines in the depopulated and impoverished areas to the rear; freight, upon which the roads depend for their livelihood, falls off here, with the result that large sections of the roads are run at a loss—a fact which merits serious consideration, in view of the unsound financial situation of almost all Brazilian railroads. According to data at hand for 1951, of the 41 administratively distinct roads, all but four showed a

debit balance, the global deficit of the remaining 37 being over one and a quarter billion cruzeiros.[3] In 1954, operation deficits of Brazilian railroads has practically reached four billion cruzeiros.[4]

There is more to the problem of getting Brazil's crops to market than the high cost of haulage, which produce of low value cannot bear. It is indeed physically impossible for the present transport system to move the products of the farms.

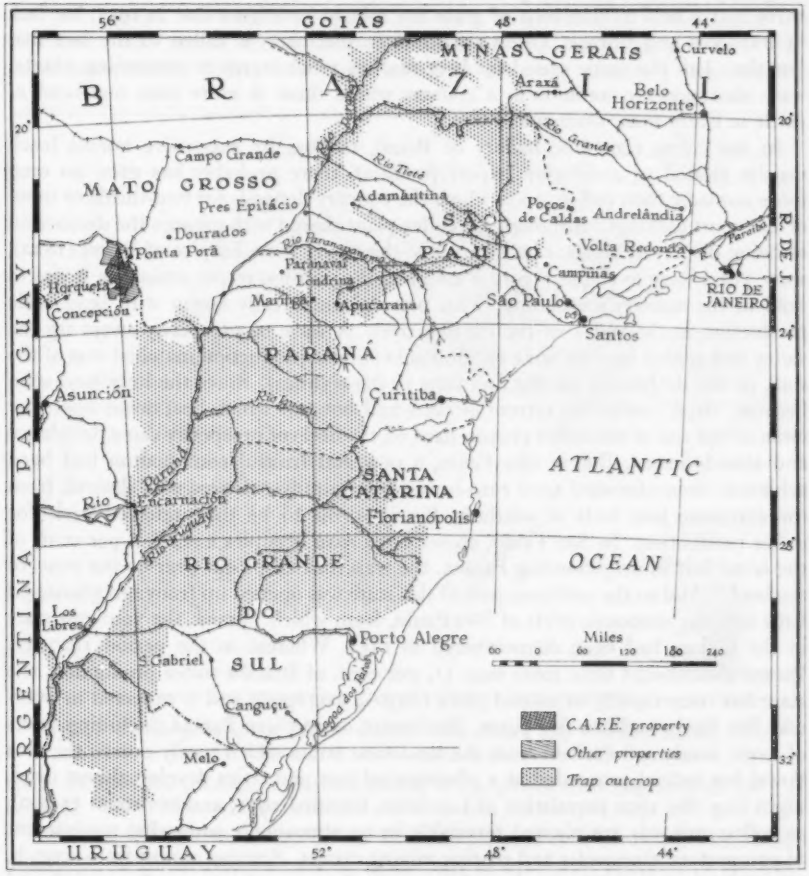


Figure 1

To be sure, some natural factors are unfavourable to transportation (e.g. the escarpment which bounds the interior plateau along the eastern and southern seaboard), but such disadvantages are aggravated by technical and administrative difficulties—lack of uniformity of gauges, for instance. Even bulky or perishable commodities, which are traditionally produced near consuming centres, have been pushed to remoter areas by real estate speculation, and this leaves an unproductive zone immediately surrounding the big cities. And so it comes about that food rots in the producing areas, while recurrent scarcities distress the city dweller.

If the increase in urban population which has occurred since the railways were built were alone to be provided for, their capacity for handling food would have to be doubled, according to one recent investigation.[5] Inadequate transport (in combination with lack of storage facilities) is responsible for the staggering waste characteristic of Brazilian agriculture. The same source indicates that probably an average of 30 per cent. of all food produced is spoiled (in basic foods, the loss may vary from less than 10 per cent. to more than 50 per cent.); in effect, about three and a half million tons of grain are said to have been lost in 1953, for lack of transport and storage. One's attention, furthermore, is called to the fact that less than half the cattle raised for beef reaches retail stores or processing plants; meat shortages are common in a country where there is more than one head of cattle to every man, woman and child.

In the entire economic history of Brazil, marked by successive booms (each usually related to a different export product), there probably has been no crop more nomadic than coffee, upon which the country depends for two-thirds or more of its export earnings. Although the coffee plant shared with tobacco the distinction of being displayed on the coat of arms of the newly born Empire of Brazil (1822), some years were to elapse before it assumed the position of pre-eminence it was to hold in the country's economy. This pre-eminence really began with large-scale production in the valley of the Paraiba river. A wave of prosperity swept up the valley and spread into the state of São Paulo (whose production matched that of the state of Rio de Janeiro for the first time in the eighties). Since the hilly land soon became "tired" under the torrential rains and hot sun which beat down upon the clean-swept soil of the coffee groves, hard on the heels of prosperity came decadence and abandonment. But in São Paulo, a new and fruitful combination had been achieved: thenceforward *terra roxa*—a deep burgundy-coloured soil, derived from the extensive lava beds of southern Brazil—came to be the preferred basis for coffee production. In São Paulo, choice *terra roxa* occupies a scant 2 per cent. of the area,[6] but in neighbouring Paraná, the trap rock crops out over 60 per cent. of the land.[7] And so the northern part of this state was opened up from and gravitated back into the economic orbit of São Paulo, from which Paraná, the youngest state in the Union, had been dismembered in 1853. Whereas in the period 1927–31, Paraná contributed little more than $1\frac{1}{2}$ per cent. of Brazil's coffee production, the state has risen rapidly to second place (1950–4 averages)[8] and is expected to overtake São Paulo within a few years. Settlement of northern Paraná (including tracts of loose, sandy soil derived from the sandstone strata which partly overlie the lava flows) has indeed proceeded at a phenomenal rate and cities develop almost overnight (e.g. the 1950 population of Londrina, founded 1931, and environs: 55,000), as coffee orchards are planted feverishly in an atmosphere somewhat reminiscent of prospectors' stampedes and roaring mining camps. Starting almost from scratch, 55 million trees had been planted by 1939; by 1954, however, they numbered 695 million![9]

The speed with which such pioneer areas of Brazil as northern Paraná are being opened up and settled is generally regarded as a promising indication of Brazilian potentialities. If the new settlements were based upon sound agricultural practices, there could indeed be no objection to the rapid transformation of the landscape. But, unfortunately, the advance is accompanied by the same wastage of natural resources which left in its wake the bald hills of the Paraiba Valley and other regions which in the past enjoyed opulence equal to that now displayed by the coffee planters of Paraná. In the northern part of this state disturbance of the

hydrological balance is constantly aggravated: many springs and streams are dry; where there were cool forests, passing trucks now raise clouds of dust, and wells must be sunk deeper and deeper in the parched earth. The changes wrought in some areas by uncontrolled gullying and wind-drifted sand stagger belief. One alarming indication of the rate at which even choice soils are degraded is the fact that "old" and "new" zones are recognized in the very pioneer fringe itself. Although the large number of young trees tends to depress average production in "new" areas, mean yield per plant here may be as much as twice that of the so-called "old" zones, immediately to the rear. If one considers that the "old" lands were settled only a few years earlier, it must be admitted that there is

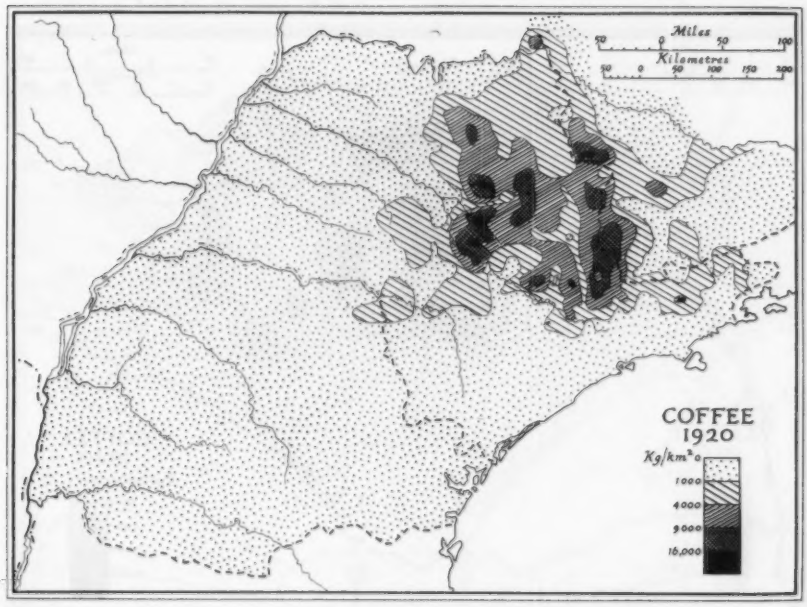


Fig. 2. Coffee growing in Minas Gerais, São Paulo and Paraná states, 1920

some truth in the statement that decadence of the coffee trees begins with the first crop.

Although the lava fields extend far into Rio Grande do Sul, Brazil's southernmost state, a climatic barrier stands in the way of unlimited invasion of the temperate zone. This fact was dramatically brought home by the severe frost of July 1953 which caused the succeeding harvest to be reduced by about 20 per cent. (in terms of expected production). Damage to coffee orchards was greatest in Paraná (about 60 per cent. of the trees were damaged or killed off, according to one official evaluation[10]), but even many regions of São Paulo, in somewhat lower latitudes, were also stricken (an estimated 22 million plants were killed).[11] Again in 1955 a large area was stricken by frost. As cold air masses flowed up the valleys of the Paraná and Paraguai rivers, temperature fell below 0° C. as far north as Cuiabá (lat. 15° 36′ S.). Coffee plantations were severely hit in São Paulo; in Paraná, some areas were completely damaged. One old hand in the coffee business, states this

was the severest frost in eighteen years and estimates that there may be a reduction of 30 to 40 per cent. in the production of the next two years. He also believes many people will abandon coffee production, especially in the newer areas where the frost struck hardest and where the young coffee bushes were killed.[12] Although tropical and sub-tropical crops can grow on the warm coastal belt of Santa Catarina, the fertile interior plateau of this state is cool and subject to severe frosts every year, and, therefore, does not possess the necessary requirements for economic production of coffee. Skirting the southern limit of production, coffee, therefore, veered westward over the plateau, crossing the Paraná river, where there are so many recently layed-out orchards that, according to the 1950 census, the number of trees not yet bearing exceeded those already in production by 50 per cent.[13] In

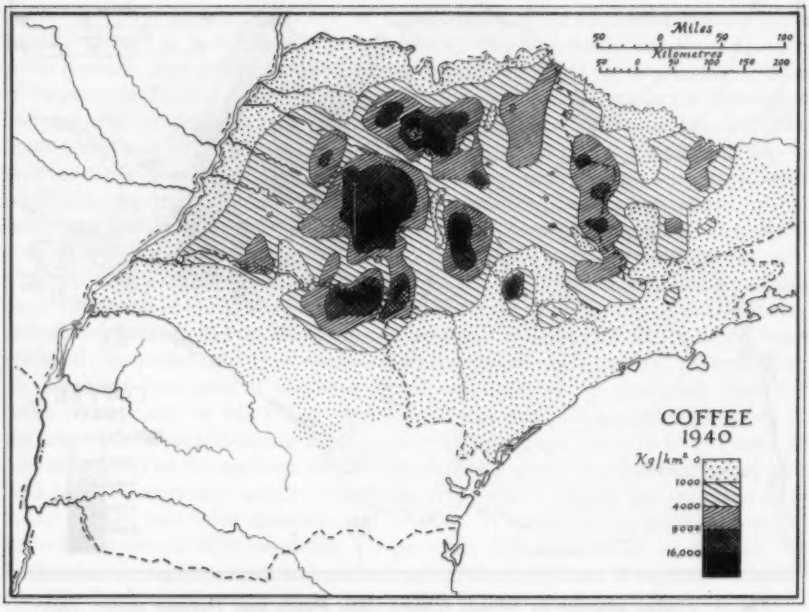


Fig. 3. Coffee growing in Minas Gerais, São Paulo and Paraná states, 1940

the state of Mato Grosso, road construction is to be speeded up against the time when 12 million new coffee plants will enter into production. Unlike climatic limits, international boundaries did not detain the planters in their search for virgin soils. Investors (including one well-known coffee baron), with headquarters in the city of São Paulo, have begun large-scale operations in Paraguay, obtaining title to forest-clad lands along the Brazilian border. One corporation, owned by Brazilian and American stockholders, is now clearing land in north-east Paraguay, with the idea of selling (mainly in Brazil and the U.S.) "packaged plantations," of 50 hectares and about 22,500 clusters of coffee seedlings apiece.[14] (See Fig. 1.)

The Paraguayan venture would seem to herald the end of the period of Brazilian agriculture characterized by the search for virgin coffee soils. Really good soils are becoming very scarce and there is every indication that Brazil is now crossing the threshold of a new phase, where restoration is likely to take the place of destruction.

Regardless of the general belief that worn-out coffee *fazendas* cannot profitably be restored, reclamation of old lands pays off handsomely, provided erosion has not progressed too far and that they are appropriate for modern farming methods. One of the most convincing examples is offered by a very successful community of Dutch settlers in the vicinity of Campinas, São Paulo state. The enterprise, based on diversified crop and livestock farming and handled on a cooperative basis, is recovering a derelict estate, which had been abandoned to pasture and to further deterioration, after improper cropping had taken its toll. The generally sandy soil has reacted remarkably well to proper management, including such measures as green manuring and the use of farm manure, garbage from Campinas and commercial fertilizer, associated with adequate tillage practices. A tenfold increase in

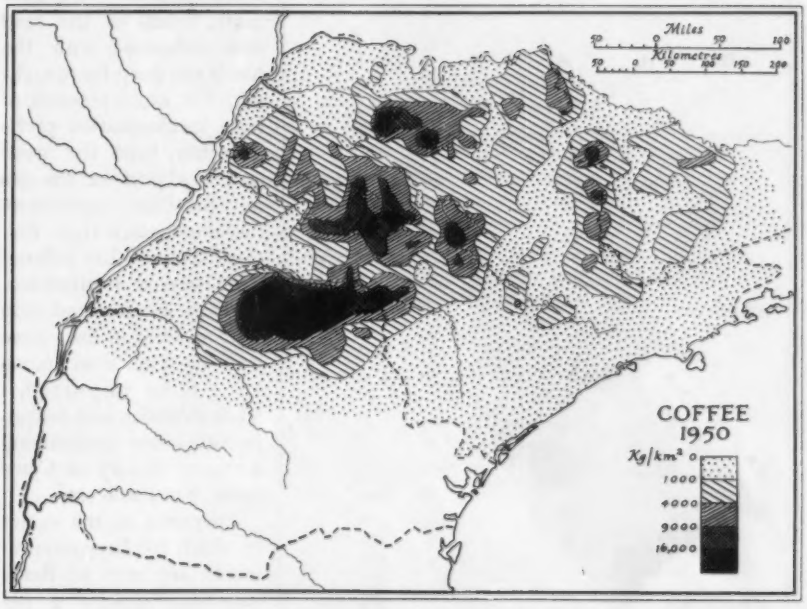


Fig. 4. Coffee growing in Minas Gerais, São Paulo and Paraná states, 1950

the water-holding capacity is said to have been observed in three years, while the output of maize per hectare has risen to as much as four and a half times the original yield.

Although the development of Brazilian agriculture has been slow, it is possible to discern certain favourable trends, not the least important of which is the shift from an essentially one-crop economy to relatively diversified farming. The job of applying science and technology to farming has only just begun; yet, here and there, agricultural "know-how" is already changing the traditional landscape of rural Brazil. In São Paulo, for instance, there is increasing acceptance of conservation practices and in a number of farms, coffee seedlings are being planted on the contour. Irrigation of coffee orchards is also receiving recognition here, in view of the much higher yields obtained (as much as 100 per cent. increase). Another interesting example is offered by the combination of dairy farming with coffee

growing: when discouraged planters turned to dairying, they—perhaps unwittingly—laid the basis for the so-called "coffee and milk" policy, now capable of assuring the cropped land a valuable supply of manure.

A significant cause of the low *per capita* output has been the lack of proper farm equipment. The plough, however primitive, is virtually unknown in many major regions of Brazil. It may be safely estimated that even now human labour alone is brought into play for the production of more than 75 per cent. of the crops, for even animal power for tillage, planting and harvesting is not generally used. The very nature of some of the most valuable crops in Brazilian economy (e.g. cacao) seems to offer relatively small opportunity for mechanization. Furthermore, much of the land now cultivated with the hoe is too steep for ploughing. Yet, rapid progress of farm mechanization probably has been the most striking of post-war changes in Brazilian agriculture (although, since 1952, further expansion has suffered from import restrictions). In 1948, an estimated 6000 tractors were in use; since then, no fewer than 30,000 have been imported,[15] while Brazilian and foreign investors are establishing a tractor factory in Campinas, São Paulo state.

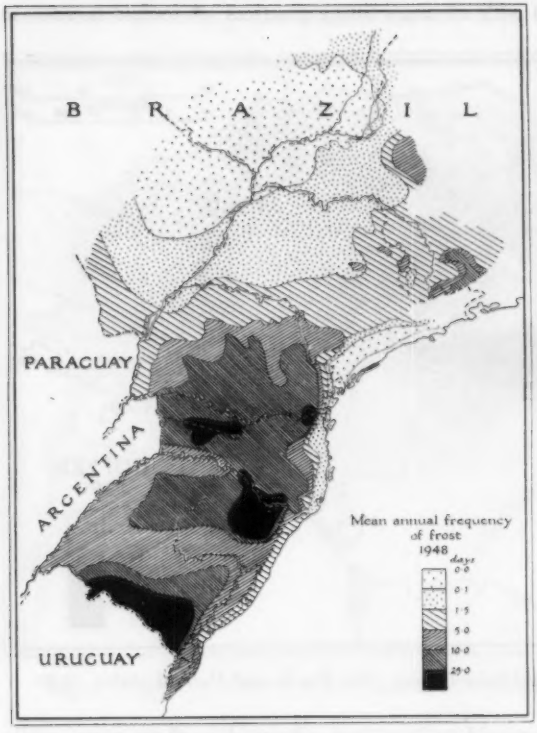
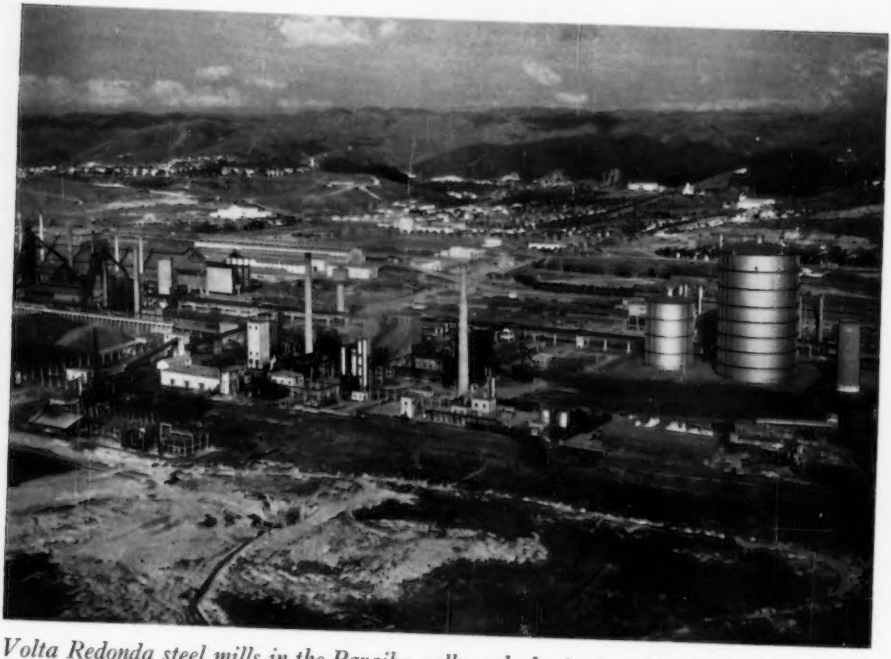


Fig. 5. Occurrence of frost in southern Brazil

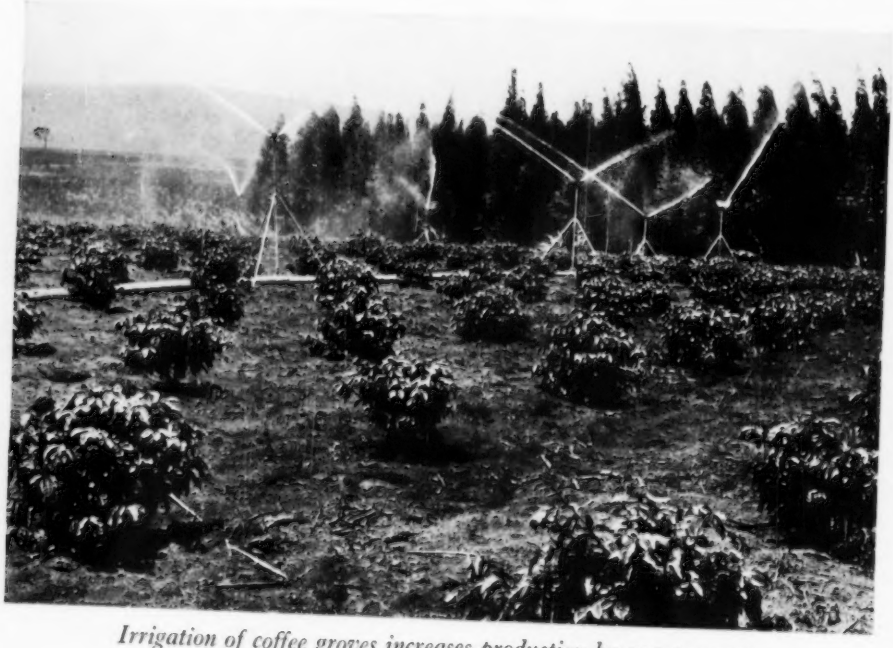
Estimates of the extent to which fertilizer requirements are met in Brazil run from around 2 per cent. to about 5 per cent.; as a rule, applications are limited to certain crops, such as cotton. Ignorance of the possibilities for restoration and soil conservation, as well as the low level of prevalent agricultural practices, no doubt are major causes for this situation, but, in the case of commercial fertilizer, prohibitive cost is the real snag. Nevertheless, it is evident that here too the situation is improving. Not only are farmers realizing the value of green and barn manure and of garbage tankage, but imports of commercial fertilizer increased from about 50 thousand metric tons, in the immediate pre-war period, to more than 350 thousand tons in 1953.[16] New factories are being set up and will further increase domestic production. Recent discoveries of phosphate rock near Recife, Pernambuco (an estimated 40 million tons of high grade calcium phosphate)[17] and the apatite deposits at Araxá in Minas Gerais (a total reserve of

Photo: Tibor Jablonsky, C.N.G.

Frost accumulates in 1955 on coffee bush left almost leafless by 1953 frost; Apucarana, Paraná



Volta Redonda steel mills in the Paraiba valley; the beginning of an industrial corridor between Rio and São Paulo



Irrigation of coffee groves increases production by 100 per cent.

more than 90 million tons inferred)[18] indicate that such sources are ample for foreseeable needs. Reserves of limestone are also adequate, but thus far geological investigation has been discouraging as regards to potassic materials.

When such problems as low productivity in agriculture, universal rural poverty and widespread destruction of natural resources are reviewed, the very root of the problem is sometimes overlooked—that is, the institutional framework of agricultural production. Although the *number* of small and medium sized farms outnumbers that of large holdings, the dominant features of Brazil's agrarian structure are large estates and extensive agriculture. The average area of establishments is large—113 hectares—and more than half of the land in farms is held in estates of over 1000 hectares.[19] Although the 1940 census showed that farms with less than 100 hectares employed 66 per cent. of the agricultural labour force and contributed 55 per cent. to the value of farm production, at the time they totalled less than one-fifth of the area in farms.[20] It is obvious that increased output and improved standards of living are not likely to be achieved where less than 2 per cent. of the population active in agriculture controls more than three-fourths of the total area in farms.[21] Not only social, but also economic and even political considerations call for urgent measures leading to a more equitable distribution of land and the establishment of a rural middle class. It is generally agreed that any changes in the land tenure pattern must be accomplished without violent disruption of the existing system of production and should be part of a general programme for agricultural development. It is useless to point out the advantages of mechanization, fertilization or adequate storage if farmers cannot raise sufficient capital to put such advice into practice. Inadequacy of capital is one fundamental cause for lack of intensity in the use of the land and attendant destruction of the soil. Small and medium sized farming enterprises are strangled for want of equitable credit, whereas middlemen rake in large profits by extending loans at high interest and then dictating prices to the farmer. Little over one-tenth of the banking loans outstanding on 30 June 1954 had been made to farmers and cattlemen.[22] What is more, even such limited credit operations favour the large land owner rather than the dirt farmer: of the total loans made in 1953 by the Banco do Brasil on agriculture and livestock, some 70 per cent. went to large enterprises.[23]

Scarcity of capital—just as lack of science and agricultural technology—is not spread uniformly throughout Brazil. Economic unbalance between what, for the sake of convenience, may be referred to here as the northern and southern halves of the country has been increasing for over half a century [24] and is a matter of current concern. Take, for instance, the so-called North-east of Brazil. The economy spirals downwards as migration, due largely to poverty and the incentive of better opportunities to the south, draws off a considerable share of the younger adults, the more enterprising members of the male population. This transfer of population represents, in itself, an invisible export of capital. As pointed out in a recent series of reports dealing with a programme for the economic development of the North-east, "the resources invested in the feeding, clothing, education and provision of other services for emigrants must have comprised a high proportion of the small share of a small national income available for the improvement of the region." [25] Furthermore, among those who emigrate, some have been small landowners: most of these, having relinquished this status, now swell the ranks of the industrial proletariat or stream towards the Promised Land of the south-western pioneer fringe, there to be employed on the new *fazendas*. Some well-to-do proprietors have also sold out their holdings in the North-east in order to purchase land in south-eastern

or southern Brazil on which to continue their activity as farm operators. If sufficient capital were available, investments, in the form of farm equipment, fertilizers, storage facilities and the like, in combination with the adoption of sound soil and water conservation practices, might well check the downhill slide of the North-east's economy. Under existing conditions, however, the gap only widens, as the region's meagre capital resources, slow to accumulate, continue to be depleted by a combination of factors, migration being only one instance. Meanwhile, the benefits of development are becoming increasingly concentrated in the southern part of the country, where profits derived from the sustained coffee boom resulted in an unparalleled accumulation of capital resources. This region now represents a predominant share of the entire national market; here, where more than half of the

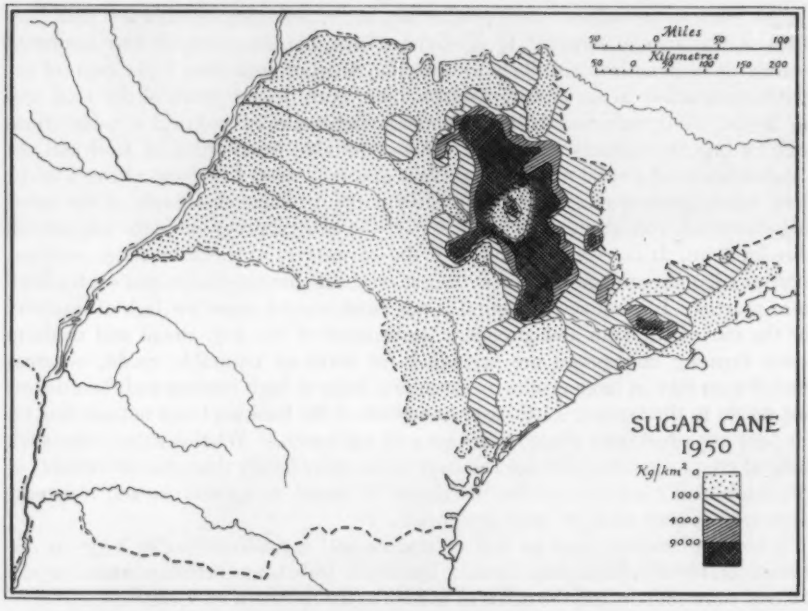


Fig. 6. Sugar growing in São Paulo state, 1950

Brazilian population (enjoying higher-than-average incomes) live, is to be found the overwhelming proportion of the industrial labour force (about four-fifths of which are concentrated in the area comprising the cities of Rio de Janeiro, São Paulo and Belo Horizonte); the largest hydraulic potentials and the greatest hydro-electric power developments; the maximum density of the railroad net; the greatest extent of roads and the immense majority of motor vehicles; here, to cut short a long list of advantages, are wider opportunities for education on all levels, including specialization in agronomics.

The trend from single to diversified crops (noticeable on a regional scale, even when not observed on the individual farm), from extensive to intensive cultivation, is more pronounced in the southern part of the country, which has also taken the lead over some traditional one-crop areas in the production of their very specialities. The change in structure is thus accompanied by a spatial shift in the relative

significance of producing areas. Consider, for example, the case of sugar-cane, once practically identified with the rainy littoral of the North-east, particularly the Zona da Mata in Pernambuco, Brazil's oldest economic region. Although favoured by a system of government-established price controls and production quotas, this state was unable to maintain its supremacy in the manufacture of sugar (at one time the country's main export commodity) and has recently yielded the palm to São Paulo state (1954 levels: respectively 5·5 and 13 million 60-kilogramme bags). Characteristically, sugar-cane represents only about 5 per cent. of the total value of São Paulo's agricultural output,[16] while continuing to be the keystone in the economy of the north-eastern cane belt. Excellent yields obtained in this belt by those plantations which, like their southern counterparts, invest in irrigation, fertilizer

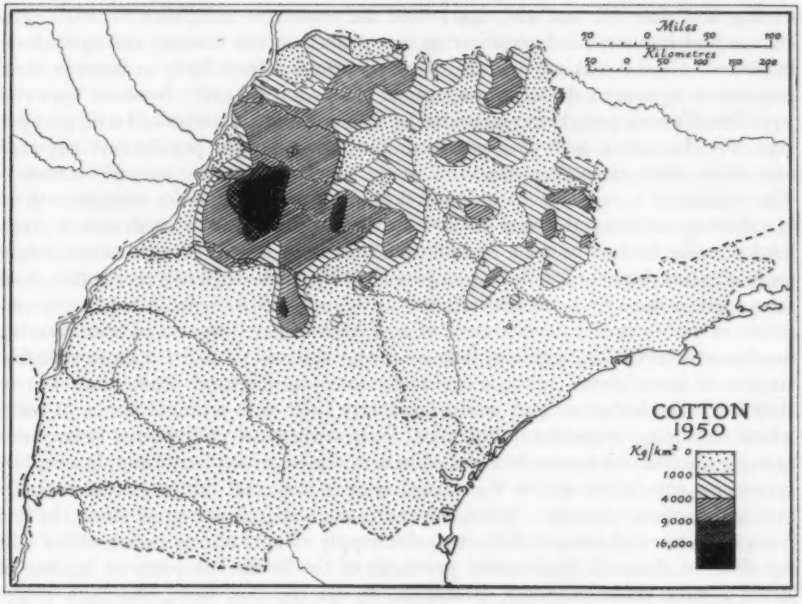


Fig. 7. Cotton growing in São Paulo and Paraná states 1950

and selected varieties of cane, are evidence that low productivity is not the result of inescapable environmental factors. A similar instance of a centre of crop production having been displaced to the advantage of the southern part of Brazil is supplied by the geography of cotton planting. Cotton, it may be noted in passing, vies with cacao as the country's second most important export crop. Up to the mid-thirties, the main cotton producing area was in the interior (*sertão*) of the north-east. In fact, the economic life of certain parts of this country (e.g. the Seridó area in Rio Grande do Norte state) still rests squarely upon the long-staple arboreal perennial which flourishes in the prevailing semi-arid climate. But in São Paulo (whose short-staple herbaceous annual contributed a meagre 3 per cent. to Brazil's output in 1930), acreage in cotton is now about four times, and volume of production more than ten times, greater than in Rio Grande do Norte.

The play of complex socio-economic forces acts with increasing intensity upon

this rise and decline of centres of crop production. So that the shifting pattern of Brazilian crop geography may be adequately interpreted, understanding of the basic relationship of plants to their physiological environment should be integrated with a thorough examination of such questions as distribution of investments. It is something of a paradox that whereas owners of big estates personally may be wealthy, their agricultural undertakings, for the most part, are undercapitalized, as shown, for instance, by inadequacy or absence of farm machinery and insufficient or non-existent storage facilities. Such operators may stretch their financial resources in order to own more land, but rarely consider ploughing back a significant portion of their returns into the land they already own, with a view to improving it. Earnings are more often channelled off to non-agricultural enterprises, especially urban real estate promotion and industrial ventures. Government policy, especially during and after the last war, aggravated the economic unbalance between agriculture and industry; industrialization was pushed to the utmost, and agriculture neglected. Capital was not the only resource drained from farm to factory: rural population represents the main reservoir of labour for industry. Between 1940 and 1950 Brazil's rural population increased by 17·4 per cent. as contrasted with 41·5 per cent. for the urban and 58·4 per cent. for the suburban population: cityward migration offset more than one-third of the rural population's natural increase.[27] The results of a 1954 survey indicate that in 76 per cent. of the *municípios* there is a shortage in the rural labour force.[28] In view of the relatively small area of cropland actually farmed by each agricultural worker in Brazil, this statement might seem questionable, but it falls into its proper perspective when one recalls that most farm work is done by hand with the hoe as the only implement. Adequate investments in and technical development of agriculture (including use of labour-saving machines) would allow industry, transport and services to utilize a large potential surplus of farm labour, without undue strain on agricultural production. But in Brazil it is the higher salaries paid by industry (higher in nominal terms, at least) which encourage migration to the cities; farm workers are pulled away before progressive methods have been introduced in agriculture, which has to supply a rapidly increasing population and is thus faced with a very real (although theoretically avoidable) labour shortage. When the enormous waste occurring all along the line from farm to retail store is deducted, the supply of agricultural commodities falls far short of demand. Inadequate provision of foodstuffs has come to be one of Brazil's most acute economic problems. If, on the one hand, the high prices reached by agricultural products may tend to draw the benefits of technology within closer reach of the farmer, on the other hand (in view of the fact that food expenditure absorbs 50 per cent. of the factory worker's budget) it is obvious that the high, and ever rising, cost of food promotes recurrent inflations.

One result of the low productivity levels of Brazilian agriculture is the insignificant purchasing power of the large non-urban group (70 per cent. of the total population lives outside demographic centres of more than 2000).[29] Domestic markets for manufactured goods are, therefore, limited and high production costs preclude the conquest of foreign markets. So the country continues to depend on the export of agricultural products to provide most of the equipment and a significant part of the essential raw materials used by industry. Whenever there is a decline in such export receipts, imports of manufactured goods must be cut back; this tends to favour the development of domestic substitutes, a tendency unfortunately counteracted to a large degree by a parallel restriction in the importation of industrial raw materials and equipment. Further examples of the interdepen-

dence of Brazilian industry and agriculture may be dispensed with: it is evident that these two economic sectors must progress hand in hand. Certainly, the striking, but one-sided, efforts to cast off, almost overnight, the country's traditional role as supplier of raw materials and crude foodstuffs have not been made without discomfort to a large section of the population. Therefore, it has been argued that industrialization, though commendable in itself, has proceeded at a pace disproportionate to the country's economic potential, the limitations of which are apt to be further aggravated if the stigma of economic colonialism remains attached to the idea of foreign investments.

And yet, when considered in the light of the resource base of the country, the outlook for Brazil's industrial prospects is far from discouraging. They rest firmly on two main pillars: vast reserves of metallurgical ores and abundant energy potentials. The mineral deposits of Brazil—with metallurgical ores in the front rank—form an ample basis for an expanding domestic industry; judicious export of surplus ore could boost dollar earnings by as much again as currently derived from coffee shipments, thus assuring means for the importation of those raw materials in which Brazil is deficient. In very few parts of the world has iron ore been found in marketable quantities, comparable in quality to some of Brazil's highest grade ore. Brazil not only possesses considerable deposits with over 66 per cent. iron, but her reserves of ore containing over 50 per cent. iron are certainly among the four largest in the world. Whereas manganese is not found in large quantities in any major steel-producing nation outside the U.S.S.R.; Brazil's high-grade ore forms one of the world's four largest reserves and is unequalled in the Western Hemisphere. Most of the other ferro-alloy metals are adequate for domestic needs; some are even mined for export.

Although an iron foundry is known to have existed in Brazil as far back as 1597,[30] the iron and steel industry developed slowly, and, until recently was based exclusively on charcoal. It was only in 1946, when the first Volta Redonda blast furnace was blown in, that the introduction of coke ushered in a new era for Brazilian metallurgy. Steel production of the Volta Redonda plant, which, since 1949, has supplied more than half of the total domestic output, reached about 750 thousand ingot tons per annum in 1954, when the second blast furnace was blown in; and eventually will reach one million tons per annum. Although other plants also are increasing their capacity and new mills have been inaugurated, output is not expected to catch up with the rapidly rising demand. In fact, after a brief slump in the period 1948–50, imports have risen along with domestic production and it is estimated that by 1960 the gap may exceed 1½ million tons a year.[31]

Despite the small unit output of charcoal blast furnaces, it is generally believed that they will continue to exist side by side with large coke-consuming plants. For not only is the best domestic coal poor in quality (containing as much as 16 to 17 per cent. ash after processing) [32] and expensive, but known reserves are relatively small. Although future discoveries may call for a significant upward revision of present assessments, it does not seem likely that Brazil will become an important coal producer. Projection of iron and steel consumption has led one expert to conclude that known reserves will approach exhaustion within less than three decades, if domestic coal is used exclusively; and within little over half a century if blended in a fifty-fifty combination with imported coal.[33] Whereas this estimate has been criticized as unduly pessimistic,[34] it must be admitted that coal reserves are indeed small for a country practically on the threshold of industrial development. Export of ore in exchange for coal seems a logical procedure. Furthermore an energetic

reafforestation programme is indispensable to assure sustained production of charcoal. The full extent to which timber resources have been destroyed in Brazil may be hard to grasp, but the fact that charcoal used by some metallurgical plants has now to be obtained at distances of several hundred kilometres certainly speaks volumes in itself. The abundant water power resources of Brazil suggest that hydro-electric power may eventually replace both local and imported fuel to a considerable extent, and that an important role is reserved for electro-metallurgy. It is relevant to point out here that Brazil possesses the fourth largest hydraulic potential in the world. Actual development of this potential thus far has been promoted largely within certain rather limited areas. A major share of the total installed capacity is absorbed by the metropolitan areas of Rio de Janeiro and São Paulo. The largest integrated system for the production and distribution of electric power in South America takes advantage of the great drop represented by the coastal escarpment. By building dams on the westward-flowing streams which rise near the edge of the plateau and installing lift pumps, waters are diverted to large reservoirs and led down through penstocks or pressure tunnels to high-head power stations at the foot of the scarp. The pattern for this type of development was set by the Cubatão project near Santos, where the power-house lies about 2350 feet below the artificial lake on the rim of the uplands. Already one of the largest power plants in the world, Cubatão's generating capacity (484,000 kilowatts) is soon to be supplemented by that of an additional underground plant close by (390,000 kilowatts). One such subterranean variation of the Cubatão-type plant was inaugurated in the state of Rio de Janeiro during November 1954; driven by waters diverted from the Paraiba valley, the Nilo Peçanha plant furnishes an additional 330,000 kilowatts to the Rio de Janeiro–São Paulo system. Whereas Brazil's hydro-electric resources are augmented by such transpositions from one basin to another, it should be noted that feelings are running strongly against further concessions which involve diversion of water from the Paraiba valley.[35]

Another recent milestone in the harnessing of hydro power was the inauguration in the period January–May 1955 of the first three units (totalling 180,000 kilowatts) of the Paulo Afonso plant on the São Francisco river, which will eventually produce about 1 million kilowatts. By building a series of interconnected plants at other favourable sites on the stretch of the river covered by its concession, the São Francisco Hydro-electric Company envisages an aggregate generating capacity of about 2,500,000 kilowatts.[36] At first the system will serve mainly the densely populated coastal area containing the capitals of the states of Paraiba, Pernambuco, Alagoas, Sergipe and Bahia. But the paramount objective of this government-promoted corporation is considered to be the development of the semi-arid interior of the North-east. About 90 per cent. of the concession (which covers an area greater than Spain) lies within the so-called "Drought Polygon;" it is hoped that electric energy will open, as it were, a new frontier in this underdeveloped region. The Paulo Afonso and associated power projects should, in effect, infuse new life into the deteriorating economy of the North-east. Since widespread irrigation is becoming feasible, considerable progress of agriculture may be expected in the area; this also offers opportunities for industrial development and may eventually attract large electro-chemical and electro-metallurgical plants. The additional generating capacity brought into play with the operation of the Nilo Peçanha and Paulo Afonso plants alone represents 25 per cent. of the total capacity installed in Brazil by the end of 1953. Such an increment, however, is unusual and the fact remains that Brazil's production of energy has failed entirely to keep pace with the country's industrial expansion. During the last years of unrestricted consumption,

Photo: Reinhard Maack

Accelerated erosion after rains advances into streets of Paranavaí, northern Paraná

Photo: Reinhard Maack

Wind-drifted sand round young coffee bush in pioneer fringe, northern Paraná

Photo: Carlos Botelho, courtesy Light and Power Co.

Water from Billings reservoir plunges 2100 feet to Cubatão power plant near Santos

loads rose at a rate of 10 per cent. per annum in Rio de Janeiro and 14 per cent. in São Paulo. New generating plants are saturated almost as soon as they start operation and chronic interruptions in industrial power deliveries result in considerable losses in manufacturing output. The same picture exists in many other areas of rising industrial power requirements.

While almost 90 per cent. of the hydraulic potential remains unused it is estimated that cordwood and charcoal are responsible for some 70 to 80 per cent. of the energy consumed yearly.[37] It is true that a trend may be observed towards more efficient kinds of fuel; thus, for instance, consumption of petroleum products has increased approximately 2500 per cent. during the last thirty-five years.[38] But, in view of the small output of Brazilian wells (little over 1 per cent. of consumption)[39] this only means further inroads on scarce foreign earnings; forecasts for 1954 indicated that the import of petroleum products alone would devour about 40 per cent. of the dollars earned by coffee exports. It is true also that, by recent estimates, potentially oil-bearing sedimentary formations cover approximately a third of the area of Brazil and that the gush of high-grade petroleum issuing on 13 March 1955 from a 9000-foot well on the banks of the Madeira river, in the vast Amazon basin, could augur the need for a considerable revision in the world geography of petroleum. Furthermore, the recent identification of uranium in the zirconium ores of the Poços de Caldas plateau (Minas Gerais) and discovery of fissionable material in various other regions suggest that Brazil may eventually find it economical to turn to nuclear fission as a source of energy. Plans have already been approved for the construction of an uranium concentrating plant, to be located a few miles from the resort town of Poços de Caldas.

In concluding, one might remark that the resource bases of agriculture and of industry allow for considerable expansion. Effective utilization of certain assets is impossible, however, without harmonious integration of the two economic sectors. Lack of capital, unsound policies and ineffective techniques represent a serious handicap which leads, on the one hand, to unnecessary destruction of certain resources (e.g. soils, timber) and, on the other hand, to incomplete utilization of other resources, found in abundance (e.g. iron, manganese).

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POSTWAR WORK ON THE WATERWAYS OF EUROPEAN RUSSIA

J. P. COLE

SINCE THE early 1930s much has been done in European Russia to develop the hydro-electric resources of the rivers and to improve the rivers and lakes for navigation, while to a lesser extent, water has also been used for irrigation purposes.[1] Several large reservoirs have been constructed to regulate waterways, to supply hydro-electric power stations and to improve navigation by deepening and, in places, shortening, existing rivers. Elsewhere lakes have been linked by canals. Since the war, interest has moved from the Upper Volga and the smaller rivers of European Russia to the Don and to the middle and lower sections of the Volga. Improved equipment for excavating and for building dams makes it possible to undertake constructional work on a much larger scale now than before the War. Table 1 shows the main works of construction and improvement on the waterways of European Russia (excluding the Caucasus, Urals and European North) before 1945:

TABLE 1. WORK COMPLETED BEFORE 1945

System	*Power station*	*Reservoir: Area in square miles. Length in miles*	*Navigation*	*Port*
Dnieper ..	Zaporozhye	about 150; 75	Locks at Zaporozyhe	Dnepropetrovsk
Upper Volga ..	Shcherbakov	1820; 90	Locks	Cherepovets Shcherbakov
	Uglich	90; 25	Locks	
	Ivankovo	130; 35	Locks	
Volga–Moscow	—	Uchinskoye (small)	Locks	Moscow
Volga–Baltic ..	Volkhov	Natural lakes	Locks Canals	Leningrad

Before the War, the hydro-electric power station at Zaporozhye (capacity 558,000 kilowatts) was completed, and navigation on the Dnieper improved. Moscow was linked by canal with the Upper Volga, on which three power stations were built (Ivankovo, Uglich and Shcherbakov) and from here navigation by river, lake and canal was made possible to Leningrad on the Baltic Sea and Belomorsk on the White Sea (see Fig. 1). Table 2 shows what has been completed since the war, what is being built at the moment and what is planned for the future.

A comparison of Tables 1 and 2 shows that several of the postwar projects are considerably larger in scale even than the Dnieper hydro-electric power station. Far reaching effects will be felt not only in the immediate areas around these various works of construction, but also in more distant regions. To give two examples: the Moscow area will receive about 10,000 million kilowatt hours of electricity annually from the middle Volga; the Caspian Sea will lose part of the water supply of the Volga, the largest river flowing into it. Among the problems and changes arising from the postwar works of construction on the waterways, the following are of particular

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interest: (1) the fall in the level of the Caspian Sea; (2) the growth of river traffic, industry and urban population in the Volga and Don valleys; and (3) the improvement of conditions for agriculture in the lower Dnieper, Volga and Don regions and the Caspian Lowland.

TABLE 2. (A) WORK COMPLETED SINCE 1945; (B) WORK COMMENCED BUT NOT COMPLETED BY MID-1954; (C) FUTURE WORK

System (year of completion)	*Power station*	*Reservoir: Area in square miles. Length in miles*	*Navigation*	*Port*	*Irrigation and water supply*
(A) Don (1951)	Tsimlyanskaya	over 1000; 125	Locks at Tsimlyanskaya	Kalach, Tsimlyanskaya	Lower Don Valley
Volga–Don Canal (1952)		Small reservoirs	9 Locks from Volga, 4 from Don	Krasnoarmeysk, Kalach	—
(B) Dnieper	Kakhovka	about 900; 125	Sea-going vessels to Dnepropetrovsk	Kakhovka, Zaporozhye	Lower Dnieper Valley, Northern Crimea
Kama ..	Levshino (Molotov)	800; 190 on Kama	Improvement for timber floating	Molotov	—
Volga ..	Balakhna (Gorky)	1000; 250	Locks. Deepening of Volga to Yaroslavl	—	—
Volga ..	Zhigulevsk (Kuybyshev)	2000; 600	Locks at Zhigulevsk. Widening and deepening of Volga	Kazan, Ulyanovsk	Volga Valley
Volga ..	Stalingrad	about 1400; 350	Locks at Stalingrad. Widening and deepening of Volga	Saratov	Volga Valley and Caspian Lowland
(C) Volga ..	Cheboksary		Widening and deepening		
Kama ..	Votkinsk		do. to Molotov		

Between 1933 and 1950 the level of the Caspian Sea fell 180 centimetres. In 1953 the lowest level in four hundred years was reached: 28 metres below sea level. The level has fluctuated considerably in historical times, and it is thought (see Bibliography, Shlyamin, B. A.) that major fluctuations come in cycles of approximately one hundred and twenty years. The level is therefore expected to continue to fall until about 1960, and thereafter to rise again. Figure 2 shows how the coastline has changed between 1938 and 1954 (from Russian atlases of these dates). The greatest differences are found in the north-east, where the sea has receded from the Sor Mertvy Kultuk. Changes can also be seen along the coast of the Volga delta and on each side of it; these are at least partly due, of course, to the seaward growth of the delta itself. Elsewhere, smaller changes of coastline have been recorded near Krasnovodsk and around the mouth of the Kura.

The artificial lakes above Gorky, Kuybyshev and Stalingrad will increase the width of the Volga several times over much of its course from Shcherbakov to Stalingrad. In places these reservoirs will be more than 10 miles wide. Consequently, evaporation of water from the surface of the Volga will be increased. Moreover, it is planned to draw off large quantities of water for irrigation (*Orosheniye*) and water supply (*Obvodneniye*) projects in the lower Volga Valley and Caspian Lowland.

As a result of increased evaporation and the use of water for agricultural purposes,

much less water will reach the Caspian Sea from the Volga. The Volga is by far the largest river flowing into the Caspian, and it normally supplies about 80 per cent. of

Fig. 1. The main hydro-electric and irrigation projects on the rivers of European Russia

the water entering by river, although its contribution varies greatly from year to year.[1]

[1] In a year when the snowfall is heavy in its catchment area, the Volga may carry 300–350 cubic kilometres of water to the Caspian. In years of little snow, the amount may only be 150–200 cubic kilometres annually (Shlyamin, p. 90).

On the other hand, part of the water lost as a result of the completion of these projects should eventually reach the Caspian, in the form of increased precipitation, or through the irrigated areas of the Caspian Lowland. Figure 2, in which the 1938 10-metre and 20-metre depths are indicated, shows the shallowest part of the northern section of the Caspian, which is the most extensive part likely to be affected by a further fall in the level of the sea. Several problems may arise, therefore, in the not far distant future.

The Baku area still supplies a large proportion of the oil produced in the U.S.S.R.[1] Much of the production of the Baku area is sent by sea-going tanker to a transhipment point, the *reyd* (=roadstead), in the Caspian Sea, about 50 miles to the south of the coast, where the navigable Volga distributary enters it, and almost 100 miles from Astrakhan. At the *reyd* it is transferred to river-going vessels and barges for distribution over the inland waterways of European Russia. A further fall in the level of the Caspian Sea would make it necessary to move the *reyd*, and might also make the approach from the *reyd* to the Volga difficult, even for river-going vessels. The work of the tanker fleet in the Caspian is already being hampered by the fall of sea level.

Fig. 2. The drying of the Caspian Sea

The planning and construction of new ports and the extension of existing ones is extremely difficult anywhere on the shores of the Caspian, and a change of level of some metres would of course threaten not only ports such as Guryev and Krasnovodsk, in areas where the approaches are shallow, but also ports such as Baku and Lenkoran, where the sea is deep offshore. On the other hand, it is considered (Shlyamin, p. 89) that the future fall of sea level could not be great enough to affect the oil industry by exposing oil-bearing strata and thus making new deposits available for exploitation, although in places offshore, derricks are in operation where the sea is sufficiently shallow.

To make up for water lost by the Volga before entering the Caspian, and to prevent a further fall of sea level, it has been proposed that water should be diverted from the upper courses of the northern rivers, Pechora, Vychegda and Onega, into the Volga. Alternatively, water from the Don and Dnieper could be diverted into the Caspian; the waters of these rivers are, however, needed for the irrigation of their own valleys, Moreover, an attempt to maintain the level of the Caspian by introducing a supply of water from other catchment areas might prove a disadvantage, should the present sources begin to increase for some reason, in the future.

[1] In 1953, 16,500,000 metric tons of oil were produced in the Baku area out of the national total of 52,000,000 metric tons. (Petroleum Information Bureau, "Oil in the U.S.S.R.".)

Turning to the growth of river traffic, it may be said that with the improvement of navigation of the Volga and the Don, and the availability for industry and agriculture of large supplies of electricity, changes will take place in the economy of large areas, and certain towns will be able to increase their industrial production. Of all the towns in the Volga and Don regions, Stalingrad (see Fig. 3), without doubt, will be in a position to develop most rapidly. The opening of the Volga–Don Canal,[1] in 1952, made Stalingrad one of the key towns on the inland waterway system of European Russia, although its importance as a point of transhipment from rail to river was consequently reduced. Of particular importance to Stalingrad itself is the fact that it can now receive coal and metals from the Donbas directly by river and canal. The eastern part of the Donbas coalfield is only about 300 miles away.

Fig. 3. The site of Stalingrad

Unforeseen difficulties[2] connected with construction and with the transportation of cement and other materials are slowing down progress on the Stalingradgidrostroy, the hydro-electric power station on the Volga above Stalingrad. When this project is finally completed, Stalingrad will receive a supply of power to supplement the output of its thermal power station during most of the year. According to a recent estimate in *Pravda*,[3] the hydro-electric station will have a capacity of 2,310,000 kilowatts and will produce an average of 11,000 million kilowatt hours annually. A bridge will carry road and railway across the Volga over the dam between Prichalnaya and Paromnaya, where train and vehicle ferries now operate. Table 3 shows how the supply of electricity produced at Stalingrad and Kuybyshev will be distributed.

Stalingrad will receive much of the 28 per cent. to be supplied to Saratov, Stalingrad

[1] See J. Colin Crossley, "The Volga–Don canal and associated developments," *Geography*, No. 186, November 1954, pp. 294–6. This article includes details of the Volga–Don Canal and of irrigation works in the lower Don Valley area.

[2] *Pravda*, 31 August 1955. In an article in this number of *Pravda*, the director of the Stalingrad hydro-electric project complains that materials are being supplied too slowly. A cement works about to be opened close to the dam will produce 8000 cubic metres of cement daily, thus enabling the work to be speeded up. Suspension railways to carry gravel and stone across the Volga are not working efficiently, and too great a strain is being thrown on the train ferry.

[3] *Pravda*, 31 August 1955.

TABLE 3. DISTRIBUTION OF POWER FROM STALINGRAD AND KUYBYSHEV

To	From Stalingrad Per cent.	From Kuybyshev Per cent.
Moscow and the industrial region of the centre of European Russia	40	60
Kuybyshev oblast	—	24
Saratov oblast	28	
Stalingrad and Astrakhan oblasts		
Penza, Tambov, Voronezh and other oblasts of the "Blackearth central area"	12	—
Volga valley area for agricultural purposes	20	16
	100	100

and Astrakhan oblasts; and Kuybyshev much of the 24 per cent. for Kuybyshev and Saratov oblasts. Like Stalingrad, Kuybyshev now benefits from access by water to the Donbas. When its hydro-electric station is completed, it will have a large supply of electricity to supplement the output of its thermal station. The capacity will be about 2,100,000 kilowatts, and the annual output, about 10,000 million kilowatt hours. In addition, it is near to the centre of the so-called "Second Baku" oil producing region and seems destined to become a great industrial centre. A new road and rail crossing of the Volga will be made over the dam at the Zhigulevsk power station, making an alternative crossing of the Volga for the railway from Moscow to Central Asia (see Fig. 4).

Fig. 4. The position of Kuybyshev

Like the other towns on the Volga, Gorky is located at a considerable distance from its nearest coalfield and like Kuybyshev and Stalingrad, it will benefit from a new supply of electricity from its hydro-electric power station. As a centre for the construction of river vessels, it is well placed to supply the needs of the growing river fleet. Kazan, Ulyanovsk and Saratov will all be on the banks of the new Volga reservoirs and will have to build new river ports to replace those which are to be submerged. With the improvement of navigation on the Don, Rostov has become a river port as well as a seaport. Tsimlyanskaya and Kalach on the Don, and Krasnoarmeysk, Prichalnaya and Volzhsky (becoming suburbs of Stalingrad) and Zhigulevsk (near Kuybyshev) on the Volga, are smaller towns which are growing as a direct result of postwar construction.

The third point to be considered is the improvement of agriculture in the Lower Dnieper, Volga and Don regions, and the Caspian Lowland. Most of the steppe region of European Russia is subject to summer droughts which, during certain years, reduce harvests and even destroy crops. It was considered possible to decrease the damage caused by these droughts in two ways: by taking measures to make the maximum use of the precipitation in the region, and by providing water from the Dnieper, Don and Volga for irrigation and for the supply of water to livestock in grazing areas.

Until the death of Stalin, much was written about the plan to plant belts of trees over most of the Ukraine, the area to the north of the Caucasus, the Don Valley and the middle and lower Volga Valley. Special belts of trees were to run parallel with the Severny Donets, the Don, the Volga and the Ural (for map, see Goroshchenko and Pavlov). The plan is mentioned in S. V. Chefranov's school text-book 'Geografiya S.S.S.R.' for 1953, but the section is not printed in the 1954 edition. This vast plan has apparently been abandoned since Stalin's death, possibly owing to the difficulty of growing trees in the steppe belt, possibly in the light of increased knowledge of meteorological conditions in European Russia. Mention is made in a recent publication on the Caspian Sea (Shlyamin, p. 91) of cyclic climatic changes over the whole of European Russia, which affect precipitation in the steppe areas and elsewhere. Observations made by the floating ice stations established in the Arctic in the summer of 1954 may have contributed to a wider understanding of climatic conditions in Russia.

Hope of improving conditions for agriculture, at least in parts of the steppe, rests largely, therefore, on irrigation. Figure 1 shows the main areas to be irrigated by the Dnieper and Volga and the area already receiving water from the Tsimlyanskaya Reservoir on the Don. The source of this information is S. V. Chefranov's 'Geografiya S.S.S.R.' for 1953. This map is omitted from the 1954 edition. The next few years will show whether or not the new irrigation schemes can remove the harmful effects of droughts in the steppe lands.

Postwar constructional work on the Dnieper, Don and Volga has thus already affected the national economy. As present work is completed, many branches of the national economy will benefit further. Among the most profound results will be the development of industry in the Volga towns, part of the plan to decentralize industry and reduce its dependence on coal supplies; the improvement of the Volga waterway; and the improvement of agriculture in large areas of the steppes.

Note: This paper was received for publication in October 1954. In October 1955 the last preparations were being made for the opening of the hydro-electric power station at Kakhovka (Dnieper). In November 1955 the first section of the hydro-electric power station at Balakhna (Gorky) was opened. The first section of the Kuybyshev station is expected to be opened in December 1955.

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FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING ABSTRACT is taken from Richard Burton's "Narrative of a trip to Harar" read to the Society on 11 June 1855 and printed in the *Journal of the Royal Geographical Society*, Vol. 25, pp. 136–50.

"After sitting for an hour at the eastern gate [of Harar], waiting the permission of the Emir to enter his walls, we were ordered by a grim guard to follow. Arrived at the prince's court-yard, we were told to dismount and run, as the subjects of H.H. must never cross the gateway or approach the palace but at a long trot. I obeyed the former and resisted the latter order. Then, leading our mules, we stood under a tree close to the state prison, whence resounded the ominous clank of fetters, and turned deaf ears to the eager questions of the crowd. It was a levee-day, and troops of Galla chieftains, known by their heavy spears and zinc armlets, passed in and out of the palace prolonging our anxious delay. At last, after being ordered to take off my slippers and to give up my weapons, a mandate to which I again objected, we were escorted by the grim guard to the palace-door. A curtain was raised. I entered with a loud salam, which was courteously returned by a small yellow man, not unlike an Indian Rajah, dressed in a comical turban and a red robe trimmed with white fur. As I advanced towards the throne, four or five chamberlains seizing my arms, according to custom, hurried me on till I bent over the Emir Ahmed bin Abubekr's extended fingers. Leading me back, they then seated me in front of the presence, while my two Somali attendants were kissing the palm and the back of the thin yellow hand. Looking around the room I remarked the significant decorations of its walls—bright fetters and rusty matchlocks. The courtiers stood in double file extended at right angles from the throne; all had their right arms and heads bared in token of respect, and whoever approached the Emir saluted his hand with exceeding reverence. At the end of my survey I was called upon by the wazir or prime minister, who sat upon a rug at the right of and below the throne, to answer a variety of questions concerning my name, nation, and business at Harar. The replies proving, it is presumed, satisfactory, I was invited to become the prince's guest during my ten days' residence, and received every day three dishes of bread and beef from his own kitchen. At subsequent visits I was admitted to the honour of a seat next to the wazir, and the Emir did not disdain to be indoctrinated with the principles of free trade in coffee and cotton. Slavery was a more delicate topic, and not being authorized to treat upon the subject officially, I contented myself with observing its operations and with preparing a scheme which will easily and surely remove this curse upon the country's industry. During my residence at Harar, the two Somal who had been sent with me from Aden behaved admirably. As small-pox was raging in the town, I found an easy pretext for hurrying my departure . . . and as a proof that my modest endeavours to establish friendly relations were not unsuccessful, the Prince wrote, immediately after my departure to Aden, requesting to be furnished with a 'Frank physician.' He finally dismissed me with a mule for myself and a letter addressed to our Political Resident in Arabia."

THE ENGLISH SCENE

THE MAKING OF THE ENGLISH LANDSCAPE. By W. G. Hoskins. *London: Hodder and Stoughton*, 1955. 9×5¼ *inches; 240 pages; maps and illustrations.* 25*s*

A VETERAN STATESMAN among the economic historians once laid it down that what the young recruit to the profession most needed was a strong pair of boots. He must get outside the Public Record Office from time to time and look at the land itself upon which its own history is written. Dr. W. G. Hoskins is one of the new school of historians who have taken this dictum to heart. He has begun to write, and inspire others to write, a new sort of local history, something of which has already reached and delighted an immense public through his broadcast talks. This book presents these talks in a greatly extended form, and the subject is made, besides, more concrete and easier to grasp by the addition of about a hundred plates and figures. Curiously enough, only two of these—both excellent—are the author's own photographs. One of the two shows Stamford, starting quite abruptly at the edge of the water-meadows where the ground begins to rise. This town, he says, is "a museum-piece from a pre-industrial England;" but in spite of his general percipience, Dr. Hoskins fails to notice the pretty geographical point of the shaping of the town's outline by the outline of the flood-plain. Indeed geography is hardly mentioned or considered throughout the book. However, he puts the case for "boots" clearly enough: "It is not only the documents that are the historian's guide. One cannot write books on this subject by reading someone else's books, or even by studying records in the muniments room. The English landscape itself, to those who know how to read it aright, is the richest historical record we possess. There are discoveries to be made in it for which no written documents exist, or have ever existed. To write its history requires a combination of documentary research and of fieldwork, of laborious scrambling on foot wherever the trail may lead."

Many readers will immediately call to mind Professor Dudley Stamp's 'Man and the land,' published in the 'New Naturalist' series early in 1955. It was a sequel to the same writer's 'British structure and scenery,' and its purpose, too, was "to trace the hand of man in shaping the scenery as we actually observe it today." [1] But Dr. Hoskins seems to have missed it and says very positively: "No book exists to describe the manner in which the various landscapes of this country came to assume the shape and appearance they now have. . . . There are indeed some good books on the geology that lies behind the English landscape. . . . But the geologist . . . is concerned with only one aspect of the subject: and beyond a certain point he is obliged to leave the historian to continue and complete it." In point of fact his book and Dr. Stamp's have much ground in common; but because of the divergency of interests and training between their authors they may well be read side by side. There is no doubt that a new pungency would be given to the historian's narrative, stimulating and alive as it already is, were he as constantly aware as is Dr. Stamp of what may be termed regional differentiation. Surface relief and drainage, soil and climate, position and juxtaposition, constitute a totality of conditions which limit and control land use, and so lie always behind landscape history. Dr. Hoskins studies the Ordnance Map both indoors and out, and so points, for example, to the contrast between "the open regular mesh of by-roads" to be found in the great area of the relatively recently enclosed Midlands, and the numerous "deep and winding lanes" which link the farms in anciently enclosed country; as, for example, in Devon. But Gonner's map (which he reproduces) showing the percentage of enclosed common fields and com-

[1] Reviewed September 1955 in the *Geographical Journal* **121** (1955) 368. See also Professor H. C. Darby's paper read to the Society on 15 January 1951: "The changing English landscape," *Geogr. J.* **117** (1951) 377–98.

mons at the end of the sixteenth century is very misleading unless one knows what proportion of each area had initially been cultivated in common. It seems likely (and indeed Dr. Hoskins admits it in a passing reference) that new fields asserted from woodland and waste were always of the small and piecemeal type, hedged around against wild deer. We want therefore to know more about the location and extent of forests and heaths during the period of the Anglo-Saxon settlement. Yet we are back again in the historians' domain when we notice the strong resemblances between the boundaries of the "hedged" zone and those of the region of Celtic culture zone in a map by the late E. T. Leeds. Indeed history and geography cannot be treated apart, and it is likely that geographers have been the worst offenders in their blindness to this truth.

There is hope, however, that we shall become much better informed if Dr. Hoskins's methods are widely followed. For he carries a transcript of the relevant charters with him on his tramps as well as the 2½-inch or 6-inch map, and has consequently made some remarkable identifications of ancient stones, banks, ditches, bridges and roads which were named as landmarks or boundaries by the early surveyors. Thus something of the former topography can be restored. It is, however, not only in respect of rural areas that it is so urgent for historian and geographer to come into closer contact, it is in respect also of towns. Questions of charters, rights and privileges, money dues and legal status are highly intricate and technical; they cannot be tackled by an untrained man. And historians find in them, as they suppose, a complete answer to the fact of the growth of towns. The geographer, on the other hand, tends to find an equally complete answer (as he supposes) in his minute and also highly technical analysis of site and situation. It is perhaps significant that (apart from a bibliographical reference to Professor Gilbert's 'Brighton') Dr. Hoskins appears completely unaware of the work of the school of urban geographers. He looks to archaeologists and historians to make an intensive study of English towns, and among the numerous questions he poses to them as demanding answer we nowhere find the fundamental one "Why is the town just *here*?" "Landowners," he recalls, "from the king down to relatively small provincial lords, founded boroughs right and left, especially where they saw merchants and traders already congregating *at some convenient spot*" (the italics are ours). Yet in Devonshire, so he has discovered, of some sixty boroughs that were created, about half never developed, although population and trade were increasing. Success only came "if one could strike the right spot" for the enterprise. The medieval landowner (or his steward) may well have chosen his location at random, for there were in England no professional surveyors with an eye for country such as the Romans had employed. But the matter cannot be left there. The urban geographer should seize upon the data concerning those sixty Devonshire boroughs, and study the list besides of the scores of New Towns, or *bastides*, founded by Edward I in France and even on this side of the Channel. An analysis of their sites would surely give some geographical substance to the word "convenient" as well as to the geographers' claims. For our modern town-planners are educated, it would seem, upon Professor Tout's historical account of the *bastides*, and they too are inclined to believe that only a town's subsequent history can show whether the site chosen was right or wrong, "convenient" or not. And by then the mischief's done.

Dr. Hoskins has much to say about town landscapes, and advises the visitor to arrive at each on foot so that he may appreciate the slight rise of the ground which is so usual a site feature. He does not speak of London, but there he would find how the "good" residential areas were related to the gravel terraces, while industrial development and workers' housing developed on the lower-lying alluvium. He himself is more familiar with the Midlands, and notes how in the days of water-power the manufacturer built his house beside the mill, but in the Steam Age went well away up on to the hill. But he adds that the factory was necessarily built by the railway or canal, and it seemed, besides, in their own interests (since they had to walk to work) to put the workers' dwellings close at hand. To the geographer it appears an odd turn

of expression to say, as this author does, that: "The germ of Middlesbrough was a single farm-house near the banks of the unsullied Tees," or again that Barrow-in-Furness "sprang from a single house"; but he found such miracles aptly described by the poet Wordsworth:

> "Meanwhile at social Industry's Command,
> How quick, how vast an increase! From the germ
> Of some poor hamlet, rapidly produced
> Here a huge town, continuous and compact,
> Hiding the face of earth for leagues . . ."

Many writers are indeed felicitously invoked to express the people's consciousness of the changing landscape—Daniel Defoe, the poet Clare, and for a townscape Charles Dickens, who pictures with gusto the frousty disorder which accompanied the building of the railway at Camden Town.

As indeed might be expected, Dr. Hoskins views the industrial revolution with mounting horror, and the industrialists themselves are bitterly chastised as "completely and grotesquely insensitive. No scruples weakened their lust for money; they made their money and left their muck." The men who ran up the needed working-class houses were "vultures" and "parasites," a reminder that we ourselves were not long ago "hyenas" to the Russian people. And when he writes of his contemporaries and the contemporary landscape the author's language is more violent still. But fortunately from his post in University College, Leicester, Dr. Hoskins has moved to a Readership in Economic History at Oxford. His home is now in a quiet spot in Oxfordshire where he can forget the "barbaric England of the scientists, the military men and the politicians" and look out of his study window on to the past. As he gazes, he draws for us a last tender and evocative picture of the "gentle unravished English landscape." The house stands where in the thirteenth century there was built a parsonage. At the end of the garden, beyond the ancient apple-trees, are stone foundations of what must have been the base of a Domesday mill, and across the stream is the banked hollow which held a manorial fish-pond. The nearby lane runs down to a bridge, which although recently rebuilt is on the site of one mentioned as a landmark in a twelfth-century charter. One has only to lean out of the window to see the ancient church, cold and deserted today save for one weekly hour, while perhaps fifty or sixty yards away, in a field adjoining the garden, there lies buried the main street of a village wiped out by the Black Death. Tinged with melancholy at this thought, and forgetting the scientists, the vultures and the hyenas, Dr. Hoskins reaches back through the centuries one by one and rediscovers Eden.

E. G. R. TAYLOR

RECENT CHANGES OF LEVEL ON THE COASTS OF BRITAIN

ZUR FRAGE DER JUNGEN NIVEAUVERÄNDERUNGEN AN DER KÜSTEN DER BRITISCHEN INSELN. By DIETRICH HAFEMAN. *Akad. Wissen. und Literatur, Mainz: Mathematisch-Naturwissenschaften Klasse*, 1954, No. 7. 10×7 *inches; 62 pages; maps and diagrams*

DR. HAFEMANN became interested in the subject of this paper when he was a prisoner of war in northern England. Later he was able to make a three months' tour of eastern and southern England and visit some of the places he discusses. He also came into contact with many of our archaeologists.

In this paper he has considered the evidence of some forty localities on the coasts

of the British Isles. There is no doubt that there is a downward movement still in progress in south-eastern England, but there are some stretches of coasts from which no direct evidence relevant to the discussion is forthcoming. The absence of any such evidence between the Firth of Forth and Caithness is interesting in view of the author's disagreement with Valentin's views.

At all the places mentioned, the author finds evidence for post-Roman flooding. This is well known in, e.g. the lower Thames, Ingoldmells, the Fens, and Somerset. Hafemann has carefully assessed a great deal of literature and contends that post-Roman subsidence also occurs in Dungeness, Southampton, the Bristol Channel, the Wirral coasts, Lancashire, the Solway, the Tyne, the Hebrides, and other places.

The amount of subsidence he gives as *c.* 4·50 metres in the Thames, *c.* 2·40 metres in Romney Marsh, and *c.* 1·50 in Ireland. In general, he assumes an average value between 2 and 3 metres. Possible causes are analysed, and whilst allowing that local tectonic movements and isostatic movements have played a part, wholehearted support is given for a recent (post-Roman) eustatic rise of sea level as the general and overriding explanation.

His views are in direct opposition to those of Valentin (*Geogr. J.* **119** (1953) 299) who endeavoured to show on the basis of tidal analysis that differential movement is taking place in these islands. He maintains that the maximum sinking is in the Thames estuary and Newlyn, and that the east coast of Scotland between Dunbar and Aberdeen is a line of no movement.[1] Valentin's tentative curves of equal movement are not entirely convincing, and although general physiographical evidence certainly points to actual subsidence in the Outer Hebrides, it may also affect Shetland and even Orkney. Hafemann devotes several pages to a discussion of Valentin's work, and naturally draws attention to the short time covered by the records at the tidal stations. On the other hand, he presents no direct evidence of any kind from the stretch of coast between Dundee and Aberdeen wherewith to confute Valentin's assumption.

Hafemann does not deny the importance of isostatic movements; his contention is that they ended at the latest in the first century A.D. He claims that archaeological evidence shows that the sinking in the south-east was, in general, no greater than in the north-west; and since he maintains all stations show signs of a transgression, and so of subsidence of comparable amount, it follows in his view that it is the result of eustatic movements of sea level later than and quite independent of the isostatic movements which may be invoked to explain our raised beaches and other phenomena.

Nevertheless, the sinking in the Lower Thames is admittedly greater than elsewhere, and despite the embanking and other factors that may have led to a rise in water level, it would be difficult for Hafemann to deny entirely some isostatic movement to account for the facts he presents. His views are based primarily on a careful assessment of written accounts and on some field work. It is fair to add that careful surveys at key localities are required before anything approaching complete agreement can be given to his views.

Moreover, however carefully an entirely *post-Roman* assessment of change of sea level is made, it should not be divorced from preceding movements. The author's arguments would be more convincing if a much longer time range were reviewed, and the difficulties implicit in drawing conclusions from such modern deposits considered.

J. A. STEERS

[1] Valentin believes the maximum upward movement is in the Central Grampians; at Dundee it may be +2·5 mm/year.

A TOPOGRAPHER'S PAST

SAID AND DONE. By O. G. S. CRAWFORD. *London: Weidenfeld and Nicholson, 1955. 8½×5½ inches; 316 pages; illustrations.* 21*s*

AS A DISTINGUISHED exponent of geographical technique in recording the remains of the past—not only of this but of other countries—O. G. S. Crawford has for half a century provided a valuable link between two subjects that have a good deal in common, geography and archaeology. It was he who invented, and persuaded a somewhat reluctant Ordnance Survey to publish, the "Period Maps" of Great Britain. It was Crawford, an observer in the Royal Flying Corps during the First World War, who first realized the value of air photography in the identification and recording of ancient settlements and communications. The first fruits of his efforts, published in "Wessex from the Air," revolutionized the study of archaeology. It was Crawford, too, who, in 1924, inaugurated the international scheme for a Map of the Roman Empire on the 1/M scale, of which sheets are still being produced today. For these reasons alone, his autobiography deserves attention from geographers.

In addition, however, to providing a very full record of his life-work, the author has, as befits the Editory of *Antiquity*, produced a very entertaining book, revealing how it was that he first came to take up what was then an unusual career. After a miserable four years at a public school, where bullying, Greek and compulsory games still arouse unhappy memories, he went to Oxford. There, defeated by the philosophical niceties of "Greats," he went over to the more factual study of geography, under Herbertson. A brief experience of teaching on Herbertson's staff soon faced him with the decision which was to govern his life; was it to be geography or archaeology? He chose archaeology. But Crawford's early training in geographical method has left its mark through all his work.

An abortive voyage with the Routledges to Easter Island was followed by a season's excavation south of Khartoum under the eccentric direction of the late Sir Henry Wellcome. He returned on the eve of the First World War. The author's wartime exploits in the Army and the Flying Corps, excitingly described, ended in a spell in Holzminden Prison Camp. This, at any rate, proved less unhappy than his four years at a public school. After the War, he came to rest, relatively speaking, in a post largely of his own making, that of Archaeological Officer to the Ordnance Survey.

Coming to rest is perhaps hardly a phrase to use of a man of Crawford's industry, vitality and admittedly impatient, if not choleric, temperament, especially in dealing with the turgid workings of bureaucracy. The picture the author gives of himself is no less entertaining than the saga of his archaeological wanderings. A man with a passion is always stimulating. Mr. Crawford has a passion for facts, facts about roads and trackways, barrows and castles, even about Roman remains though he admits they sometimes bore him stiff. To him, speculation is anathema and the historical hypotheses of "thinkers" from Lucretius to Jean Jacques Rousseau he dismisses, with some courage, as a futile waste of time. There is, accordingly, no idle dreaming in this book, few flights of imagination, except perhaps in the early, and charming, chapters about the joys and anguish of childhood. It is for the most part a record, as precise as an excellent memory can make it, of what was said and done.

One might think that this would make pedestrian reading. But Mr. Crawford's facts are interesting enough to do without too much literary embellishment. He is also a good "journalist" and he says what he has to say in a language as direct and vigorous as his tramps across the countryside in search of new sites for the map.

No man with a life as venturesome and productive as Mr. Crawford's can fail to have lessons to teach, and he says much which is worth saying about the importance of archaeological survey as a tool of history, and about the educational value of what

one might call the public relations of archaeology. Of the value of archaeological survey, his own work—some of it published in this *Journal*—is an admirable illustration. By his discovery of sites and his accurate placing of them on the map, by relating them to the written record, by his perception of their significance in relation to physical environment and to other contemporary settlements linked by road or trackway, Mr. Crawford has probably added more to historical understanding than many an archaeological excavator. It is a technique which is especially valuable today when the costs of excavation, in the Near and Middle East for example, are so prohibitively high that little more than *sondages* can be attempted. But archaeological survey requires a geographer's eye as well as an archaeologist's knowledge and a surveyor's technique. Here Mr. Crawford has been fortunately equipped, and he is a living example of the importance to an archaeologist of the geographical point of view.

Mr. Crawford presents himself in his autobiography as neither an intellectual nor a careerist but, by nature, an honest countryman. It is, in some respects, a misleading self-portrait. It suggests, among other things, a sort of rustic unawareness of the needs and interests of that product of an urban age, the so-called man in the street. Mr. Crawford, when he founded his excellent journal *Antiquity* (about which a great deal is said in this book) added a new technique to archaeology—the technique of public relations, and public appeal. The *Illustrated London News* had, it is true, published, and continues to publish, most readable and authoritative articles by professional archaeologists for the benefit of the general public. But *Antiquity* was the first journal of its kind wholly devoted to the past, and it has played no small part in exciting the immense public interest in archaeology that is such a feature (especially of broadcasting and television) today. Archaeology—unexpectedly from so specialized and exacting a branch of learning—has of course itself provided some remarkably gifted natural performers. But who would have thought a decade ago that an eminent professor of the archaeology of the Roman provinces and President of a select Society of Antiquaries would become the "T.V. Personality of the Year;" or that a specialist in prehistoric archaeology at an ancient university would become the urbane Chairman of two of the most popular programmes in the history of broadcasting in this country. There are no doubt scholars who frown on this, who see in "popularization" the death of true learning. But should they? The man in the street has now at least some inkling of what ancient art and ancient history mean, and the relics in museums which he visits in increasing numbers are now related to the life and not only to the death of his ancestors. The standard of British scholarship in archaeology, meanwhile, is as high as, if not higher than, before.

Public interest in archaeology, however, is by no means confined to works of vulgarization. The articles in *Antiquity* are as valuable very often to the professional archaeologist as they are of general interest to the layman. This is equally true of the remarkably successful "Pelican" archaeological series. Some of these books, at prices any member of the public can afford, are—like Ghirshman's 'Iran' or Pallotino's 'Etruscans' —translations of standard works by world authorities. Others, like Professor Gurney's 'Hittites,' are specially written. Many contain the results of new research and most of them are as valuable as text-books as they are palatable to the general reader.

In his book, Mr. Crawford stresses the educational importance of this work of popular interpretation. Geographers whose subject is more suitable than most for this treatment might well reflect on what he says, and on the clarity of the language in which he says it.

L. P. KIRWAN

REVIEWS

EUROPE

THE ISLES OF LEWIS AND HARRIS: A study in British Community. By ARTHUR GEDDES. Edinburgh University Publications: Geography and Sociology No. 2. *Edinburgh University Press*, 1955. 9×5½ *inches;* xvi+340 *pages; maps, illustrations, diagrams.* 44s

The first one-third of the book, styled "Island, Work and People," contains a geographical survey, which is almost entirely a verbatim reproduction, with some alterations in sequence, of articles published by the author elsewhere, particularly in the *Scottish Geographical Magazine*. The only acknowledgement of this, however, is "for the loan of blocks." The handsome folded coloured map of vegetation appears to differ from the old original only in that the words "Scottish Geographical Magazine, 1936" have been deleted from the top. The lack of acknowledgement would therefore seem to be not entirely accidental and apart from the question of courtesy to the original publishers many readers may feel offended that material up to twenty years old is now being offered as new. The reviewer has not attempted to ascertain how much of the remainder of the book is original.

Most reluctantly the reviewer must express his profound disappointment with this book. An enormous amount of miscellaneous information by no means confined to the Lewis has been assembled, and while a logical enough set of chapter headings and sub-divisions is used as a framework, fragments appear to have been stuffed into it over the thirty years in which the book has been in preparation. The first twenty-five of the thirty-seven pages of chapter I, for example, entitled "Environment and Landscape," are concerned with house types, size of farm labour team, language, social organization, migrations, economic history, administrative boundaries, etc. Digressions and irrelevancies of all degrees abound: for example, we are given a description of the Iona Community; we are reminded of the derivation of the word "bible" and there are some remarkably banal passages of padding such as "the team may be 'small,' 'medium' or 'large'" (p. 18); "The difficulties of soil and sea and of the whole economic situation are great, and must be understood" (p. 25); "On 11th November came St. Martin's Day, and in December Christmas once again" (p. 166). On the other hand the influence of centuries of Norse domination of the islands is barely referred to. Over and over, the fact of communal working of land and of other co-operation in rural activities is laboured as if they were peculiar to Lewis instead of being characteristic of simple and small-scale communities everywhere. The Welsh mining village or an East End back street can probably produce as much sense of "community" as any crofting township.

More seriously, there is confusion of time and place: it is not always clear whether the text refers to the present or the past, the Lewis, Hebrides, Scotland or the "North and West." There are some quite remarkable assertions with no attempt at proof, for example (on p. 104) "Yet different communities are distinguished by marked racial types or strains." What constitutes racial types or strains? How are they distinguished? On p. 205 "The Gael possess common sense, keen observation, ready wits and accurate memory." Nowhere is it explained just who is "The Gael" but throughout most of the volume the Gael is idealized, as above, to a nauseating extent. Whatever is good is ascribed to them, whatever is bad to government or to others outside the Gaelic pale. To the author's credit it must be added that this attitude is dropped in the latter chapters and some quite serious Gaelic departures from grace are recorded.

There is some downright nonsense. The geographical survey begins with an

attempt to establish that the Outer Hebrides "is no mere fringe but a heart of Britain." A perspective sketch of Europe from above and west of Lewis (Fig. 1) (without acknowledgement to the 'New Naturalist,' where it occurs in almost identical form) presents a novel and thought-provoking view of Europe but does not make the Hebrides one whit the less peripheral to the main land mass except in the sense of the Highland shepherd who, on his return from the metropolis, pronounced that "London is a fine place, but remote, very remote." Again, on p. 35 is a crude black and white outline map on which land above 500 feet is shaded and cliff coasts are shown by a thicker line. This is entitled "Relief" and we are invited to "note the low plateau characterizing Lewis." With the aid of one contour! Again at p. 128, on inshore fishing ". . . no township can legally keep away strange boats, nor even steamers beyond the three-mile limit. This loss of communal rights stands in the way of remunerative fish-farming and its promise"!

Only praise is due to Geddes's insistence that the non-material must not be overlooked: "Not only the place but the people are to be understood, . . ." Throughout the book, too, the reader will have the constant stimulus of asking himself what is the precise meaning, if any, of sentences and phrases such as "A study in British community" (sub-title), "an interpretative chain of evidence" (p. vii), "The fascination of Gaelic community is, first, that its elements stand out so clearly, and secondly, that links were forged in clanship which made its living chain, though heavy, a thing that shone with pride and beauty too" (p. 134). R. M.

SOILS OF EUROPE. By W. L. KUBIENA. *London: Thomas Murby*, 1953. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 318 *pages; illustrations.* 75*s*

In 'The soils of Europe' Dr. Kubiena has made a forceful attempt to produce a comprehensive classification of European soils on the basis of the soil profile: that is, the structure and composition of the sequence of horizons between the weathering-zone and surface apparent in a vertical cross-section of the soil. It must be remembered that to a much greater extent than for biological species the significant features of the soil profiles at different sites within an area are likely to show continuous variation between the extremes for the area, corresponding to the continuous variation of some of the soil-forming factors. Necessarily, therefore, the soil at a particular site must be classified, and mapped, as the soil species from whose type-profile the actual profile differs least in significant features. In view of the bewildering number of systems of classification—based on pedological, agricultural, technical or purely empirical criteria—at present employed in Europe, a generally acceptable classification as comprehensive as Dr. Kubiena's would indeed be welcome.

Dr. Kubiena has classified soils on a modified Linnaean system, making use as far as possible of names already in use, and broadening the application of local folk-names to describe soil types not conveniently named so far. The classification is based upon Soil Types (corresponding roughly to the Great Soil Groups of the American classification) which are subdivided by stages into Sub-Types, Varieties and in a few cases Sub-Varieties, according to features of the soil profile, each level being described by further additions to the Type name. Since the Soil Series level of classification at present employed as the cartographic unit on American and English soil maps is said to correspond to the next level below Dr. Kubiena's Soil Varieties (that is, that Soil Series are local sub-divisions of the Soil Variety), the Variety is presumably roughly equivalent to the Soil Family level of classification proposed for the former system. There is no equivalence between any of Dr. Kubiena's levels of classification and the Soil Association concept employed by the Scottish Soil Survey, by which a sequence of soils differing only in profile features resulting from changes in the hydrologic factor are mapped as one Association. The large extent of the areas in Europe (and Western Europe in particular) in which one or other of the factors of relief, soil parent material and hydrologic condition is the predominant factor in determining the form of the mature soil, is reflected in the large number of Soil Types proposed

here for soils described as Azonal or Intrazonal on the American classification. This development from existing classifications is very welcome.

In spite of the considerable and obvious merits of Dr. Kubiena's classification there is room for considerable disagreement among soil scientists over the significance of the differences between some of the Soil Types suggested, and even more so over the uniformity of the levels of classification. Some of the new names will arouse criticism; for example, Syrosem and Serosem are too similar for colloquial use. And one would have wished for a more detailed comparison between Dr. Kubiena's Soil Types and the Great Soil Groups already widely used.

The geographer will find the list of synonyms useful whether or not he uses this classification, but will find a few surprising omissions. He will be glad to note the appearance of a soil classification at a level intermediate between the Great Soil Groups and the Soil Series (see, for example, a recent review of 'Soils of the Wem District of Shropshire' *Geogr. J.* **121** (1955) 210) but may find it difficult to relate the classification to the legends of existing soil maps, and will certainly find it difficult to use the classification as a basis on which to prepare soil maps *de novo*. Many of the illustrations are excellent, but in the same way may be difficult to relate to the cartographic units of existing soil maps. The use of slightly stylized coloured illustrations of type profiles by trained artists, of the style shown here, is an innovation which it is to be hoped will be widely followed.

The merits of Dr. Kubiena's classification are to some extent obscured in the English translation by the idiom, which is largely Continental, and the terminology, which is often obscure and sometimes misleading. In addition the classification is made to appear more complicated than it is by insufficiently detailed cross-references between keys, text and illustrations, by badly chosen running titles, and by the numbering of Sub-Types and Varieties, for which the numbering is continuous throughout the text regardless of changes in Soil Type. P. H. T. B.

ASIA

ASIA EAST BY SOUTH: A cultural geography. By JOSEPH E. SPENCER. *New York: John Wiley; London: Chapman and Hall*, 1954. 11×8½ *inches;* x+452 *pages; maps and charts.* 68*s*

There has long been a need for a regional geography of "Monsoon Asia" which should, by emphasis on the distribution of cultural differences, demonstrate that regional geography is more than regional *economic* geography and at the same time help to overcome one of the chronic failings of the West—the tendency to be self-centred and, in particular, to imagine that it was the West alone that civilized and "developed" the Orient. Professor Spencer's book does much to meet these needs. His Part I, it is true, has a conventional beginning in terms of relief, climate, and so on, but it goes on to consider the systematic geography of cultural phenomena; and Part II is entirely given over to the "Regional Growth of Culture" in each of the current political divisions of "Monsoon Asia." All of these regional chapters are interesting, and some, especially those on China and the Philippines, read very well indeed.

The book, however, has its failings, at least from the point of view of a British or British-trained Asian geographer. One of the most glaring concerns the place of physiography: on the whole the systematic chapters strike one as being over-descriptive but not sufficiently genetic in treatment, while there is a lack of integration between the systematic and regional sections; there are also a number of errors of fact. Another failing is that in the regional chapters the treatment is too historical and does not sufficiently demonstrate the functioning of cultural factors in contemporary geography. The sections on China seem to reveal a much greater depth of understanding than those on India. Some statements are naïve (or, alternatively, written for naïve readers): for example, "the Indian 'bazaar' carries a different atmosphere

from the retail merchandizing section of a mid-western American market town" (p. 138). The maps are a little crude, and the author's style, though sometimes pleasant enough, is at other times apt to grate, at least on English ears. An Englishman, moreover, can hardly approve of the reference to his national game (made in connection with the current truce in Indo-China) which runs: "In a British analogy, a long inning of cricket has been called and the sides have adjourned for tea . . . . Another round at bat in the inning will come sooner or later" (p. 253). Perhaps when a second edition is called for (and it deserves to be called for) Professor Spencer will himself have "another round at bat in the inning" and, by correcting some of the faults of his book, make it an even worthier vehicle for his eminently desirable point of view.

B. H. F.

MALAYA, INDONESIA, BORNEO, AND THE PHILIPPINES. By C. ROBEQUAIN. Translated by E. D. Laborde. *London: Longmans, Green*, 1954. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+456 *pages; maps and plates.* 30*s*

This is a revised edition of the author's 'Le monde Malais,' translated into English. The translation is of the very high standard that we have come to expect from Dr. Laborde; faithful to the author's diction, yet reading perfectly smoothly and seldom if ever betraying the innumerable difficulties of his task. In addition he has helped the English reader by converting all applicable statistics from the metric system and by regrouping some paragraphs. The book aims to give a comprehensive geographical, economic and political account of the area over which the Malayan tongue has spread. It was inspired partly by a visit to the western parts, and by very extensive reading and live interest in the whole area.

Part I is devoted to "general features"; and Part II to more detailed accounts by countries and regions. These are of direct interest to the geographer. Climate is explained generally by monsoonal arguments and some reference is made to the complexities of equatorial air-masses. The distribution and variety of species and types of vegetation and fauna are investigated. No general section is given to the soils, although they are taken into account in individual regions. Professor Robequain is not content with generalizations alone, and uses a wealth of statistics to illustrate the unity or diversity of this area; his descriptions of local detail and observations are particularly vivid and sufficiently absorbing to break the thread of more general arguments on such subjects as patterns of structure and settlements, or ethnic distributions. But when considering the wider significance of this detail he makes some good analyses, for example, of systems of cultivation, and the essentials of Java's physiography and position.

Parts III and IV consider the many-sided achievements and problems of colonial expansion. The geographical underpins are necessarily less prominent but the significance of basic patterns is not lost. It may appear that the author has eulogized the colonial systems; but while he rightly acknowledges their undoubted economic success judged by production and commerce, he is not unmindful (especially in Part IV) of their shortcomings and the local problems they create, and has attempted to assess their historical achievement in the light of contemporary as well as more modern attitudes.

Revision of the text, published in 1946 and referring mainly to pre-war conditions, has been a major difficulty. Recent statistics and short footnotes have been inserted, and some omissions made, throughout; the most extensive alterations are in the new postscript on political emancipation, which attempts to do justice in short space to the radical postwar changes. The varying forces of current external contacts and internal rivalries are only very briefly sketched, but since, to quote from the author's foreword in the French edition, "historical and geographical factors will direct or at least limit the course of events, and past experiences may enlighten future ways," this book will continue to be of interest and use to a wide range of readers.

A different and varied set of photographs has been used. Some maps have been

improved or extended and a few new ones inserted; it is regretted that more could not be included. Without some explanation, the oil symbol in Figure 35 (p. 280) may mislead in view of the statement (p. 285) that "there are no oil wells in the Philippines." The bibliography has been augmented. The gap filled by the French edition has since been somewhat modified; Professor Dobby's 'Southeast Asia' covers a wider area and has a different angle of approach, but the two cover much common ground and their different methods and approaches are complementary and instructive. In addition there are C. A. Fisher's able analysis of the political geography of South-east Asia (in East and Spate (ed.): 'The changing map of Asia'), and Professor Gourou's 'The tropical world,' which sees the essential problems of the 'Malay world' in a wider context. Altogether, for this unique area the reader in English is provided with more than the elements of regional geography. E. P.

HIGH ADVENTURE. By EDMUND HILLARY. *London: Hodder and Stoughton*, 1955. 8×5½ *inches; 224 pages; maps and illustrations.* 16*s*

Ed Hillary is essentially the man of action, the doer and the goer. By 1953 the restless speed of his Himalayan climbs had become a constant source of astonishment to his companions, who found it very difficult to keep up. They knew, as the general public did not, that he must be a very likely starter for the top of Everest. But they also knew that if he could be persuaded to commit his many climbs to paper, he had a crisp command of language and a faculty for telling a story that would ensure a good book.

The problem before him, however, has not been quite so simple as that. Obviously, the summit of Everest was also the peak of his climbing career, and the reader would want to know a lot about that—but could he better his account in 'The ascent of Everest'? Equally obviously, 1953 was only the flowering of a mountaineering technique which had been developing over a number of years. Therefore the book should be an autobiography, leading through other mountains to this Everest, the greatest of all.

'High adventure' starts, then, with New Zealand and boyhood; but the need to get quickly to grips with the Himalaya allows little time to linger here. I could not help wishing for a fuller portrait of Harry Ayres, for whom Hillary clearly has a great admiration and of whom there is a photograph. By page 20 we are in Garhwal with the excellent New Zealand expedition, then on Shipton's momentous reconnaissance of the southern approach to Everest. 1952 brought a second expedition under Shipton, the attempt on Cho Oyu which was also a try-out for Everest the following year, supposing that the Swiss attempts should fail. Much the most interesting part hereabouts is the brilliant clandestine crossing of the Nup La which brought Hillary and George Lowe to the north side of Everest—indeed beyond Camp III on the old northern route up the mountain. This brings the theme of Everest to the fore again and prepares the reader, by way of the Swiss expeditions, for the 1953 expedition which occupies the last hundred pages.

Inevitably Hillary goes at a fair speed, almost as fast as his climbing pace, through the first stages of the 1953 journey; lingering, however, at the icefall, which was in a sense a personal triumph. The speed of the narrative has the disadvantage that there is little room for pen-portraits of people or for scenic reflections, but the corresponding advantage, as we go higher, that he is able to give in increasing measure what the reader most wants from this book, the thoughts and actions and sensations of Edmund Hillary on and near the top of that mountain. The story works to its climax, certainly to its most absorbing chapter. I had thought that it would be impossible to improve on his account in 'The Ascent'; but there is here a wealth of unsuspected detail, and a tribute to Tenzing, which must make the Great Day sparkle in imagination with new colours.

Sincerity, generosity (as in the acknowledgements to Eric Shipton and John Hunt), modesty but no false modesty, a direct and open-hearted New Zealand speed of action as of writing: these seem to me the qualities of the man as of the book. The

power that brought it together was Everest, whose presence is sensed throughout. In the two hundred pages that separate the summit from a New Zealand bee-farm are packed the remarkable journeys that made Ed Hillary a mountaineer worthy to set the crown of achievement on the enterprise of 1953. W. N.

THE NARROW SMILE: A journey back to the North-West Frontier. By PETER MAYNE. *London: John Murray*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 264 pages; maps and illustrations.* 18*s*

In his 'Alleys of Marrakesh' Mr. Mayne appeared to be at home amongst his strange neighbours, but there is something missing in his new book. Perhaps the clue is on the last page; Mr. Mayne was seeking something which he failed to find, namely himself, not perhaps an uncommon experience to those who try to revive the past. His descriptions of journeys in overloaded buses, his conversations with Pathans, his accounts of dances and visits to Frontier posts are all vivid, but he seems to be moving as a shadow amongst realities. He depends largely on conversations and personalities to achieve his effect, so that the impression is slightly blurred and seems to lack sufficient background knowledge. Apart from what he has to say about old friends, Mr. Mayne gives a valuable account of the administration of the Frontier areas by Pakistan. Relations between the Government and the tribes appear happy and the Political Agents well capable of carrying out their task. Gone are the large bodies of regular troops and in their stead reliance is placed on levies and tribal responsibility. Pakistan may well feel proud of the situation as described in 'The narrow smile,' whether it is the result of deliberate policy or due to the unifying influence of a common religion.

One of the most interesting sections of the book is that dealing with the author's visit to Kabul, where his enthusiasm and hopes became gradually smothered in a fog of charming obstructionism. He made a number of good friends and believed that he had overcome the prejudice towards an Englishman with Pakistani leanings, but he underestimated the strength of the feeling in regard to "Pashtoonistan," and the inability of the Afghan to appreciate that he was a true friend of the Pathan. "Pashtoonistan" naturally features largely in this book; it emerges not so much as an altruistic scheme to benefit the Pathan as a political weapon aimed at weakening Pakistan. This situation has been welcomed by some and it is not only the tribesmen who have used it to harass the government. The idea does not bear close scrutiny; "Pashtoonistan" as conceived at present does not include Pathans living in Afghanistan, but it does claim areas occupied by races such as the Baluchis and Brahuis, who cannot reasonably be considered suitable candidates. Only if "Pashtoonistan" is to embrace all Pathans, whether Afghan or Pakistani, and no one but the Pathans, would it be worthy of any consideration. Nor do Mr. Mayne's conversations with the people confirm any genuine desire for such a creation.

This lively book can be recommended to anyone who wishes to revive memories of days among the Pathans and also to those who wish a firsthand account of conditions in the tribal areas as they were a year or two ago. J. E. F. G.

THE WISE MAN FROM THE WEST. By VINCENT CRONIN. *London: Rupert Hart-Davis*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 299 pages; map and illustrations.* 18*s*

Mr. Cronin describes with vigour, in the florid but powerful style which his imagination demands, the life of the Jesuit Matteo Ricci, who first interpreted the far West to the Middle Kingdom and in return gave to the West its first precise knowledge of the whereabouts, customs and civilization of Cathay. Ricci was born in the year in which St. Francis Xavier died in sight of the country he was never to enter, but though he was inspired by his predecessor's zeal and energy he possessed in addition to those qualities the peculiar talents and sympathy that were necessary if a foreigner was to penetrate the barrier of Chinese suspicion. In the tradition of the Society, Ricci was all things to all men: many of his activities, particularly as linguist, cartographer, instrument maker and horologist, are of great interest to specialists; to him

and to his biographer they are of only incidental importance, for Ricci used his talents always with an eye to the establishment of the church in China, and Mr. Cronin's first aim has been to describe not the scientific achievements of his subject but the character of a devoted and single-minded hero. He pays tribute, too, to the superior whose support and guidance lay behind Ricci's mission, and in a digression he describes the pathetic end of Bento de Goes' journey from Agra to Suchow—where he was met by a messenger from Ricci at Peking—which finally established the identity of China and Cathay.

Ricci entered China, on sufferance, in the dirty grey of a bonze; he learnt that the despised garment made it impossible to approach the educated classes, and later adopted the silken gown of the "graduate," a symbol of his determination to master the language and learning of the East and of Christianity's readiness to welcome all that was precious in Eastern thought. His work was ruined by the friars, but three hundred years after his death Rome recognized that he had been right. R. H.

THE INNOCENT ON EVEREST. By RALPH IZZARD. *London: Hodder and Stoughton*, 1954. 8×5½ *inches; 256 pages; illustrations.* 16*s*

This was not Ralph Izzard's first visit to Katmandu as he had been there in 1947. In this book he tells of his attempt to "gate-crash" the Everest expedition and to report on it as an unofficial observer. In the course of his story he shows how energy and initiative can overcome most things and how, despite official discouragement, he was able to get as far as the Khumbu glacier, which in itself was a considerable feat.

His book has the charm of an informal account of travel in a lovely country with delightful people. He met all types and classes and was able to give a very fair picture of Nepal. His extraordinary gang of porters, whose love of a party he seemed to appreciate to the full, make the story all the more amusing and enjoyable, since few men would have had the patience to bear with their shortcomings and appreciate the loyalty which lay behind their more irritating characteristics.

The first half of the book deals with his negotiations in Katmandu and his preparations, while the second part covers the journey itself to the foot of the glacier, arriving just at the moment when the climbers were passing out of sight into the Western Cwm. He has perhaps nothing new to tell those who have travelled in the Himalaya, but he brings to his expedition a freshness of outlook and an appreciation of details which might have seemed ordinary to a less understanding writer. It is in fact the trained journalist speaking instead of the amateur. If perhaps he has little news to tell, his book is still worth reading for this reason and for the interest he takes in everything whether it is the Abominable Snowman or Sherpa customs. The illustrations, which are in the main photographs taken by the author himself, are excellent. J. E. F. G.

HISTORICAL RECORDS OF THE SURVEY OF INDIA: Vol. III, 1815 to 1830. Collected and compiled by Colonel R. H. PHILLIMORE, C.I.E., D.S.O. *Dehra Dun: Geodetic Branch, Survey of India*, 1954. 11½×8½ *inches;* xxii+534 *pages; maps and illustrations. Rs.*20 or 31*s*

The third volume of Colonel Phillimore's self-imposed and monumental work, upon which he has been engaged for the last twenty years, opens with the appointment of Colin Mackenzie as the first Surveyor-General of India (thus coordinating the topographical work of the three Presidencies) and with the last days of William Lambton, founder and first Superintendent of the Great Trigonometrical Survey of India, which began in the early days of the century as the Mathematical Survey of Madras. The first two volumes of the Historical Records were reviewed in the *Geographical Journal*, **111** (1948) 121, and **117** (1951) 97. There was no leisured retirement for these devoted men; both died in harness still intent on their life's work: Mackenzie near Calcutta on 1 May 1821, at the age of sixty-four, and Lambton, about sixty-seven, near Hinganghat in Central India on 23 January 1823. The Topographical and

Trigonometrical Departments remained separate until George Everest succeeded Lambton as Superintendent when the Great Trigonometrical Survey first came under the orders of the Surveyor-General. This volume ends in 1830 when Everest succeeded as Surveyor-General while retaining also the post of Superintendent of the G.T.S.

Men reveal their characters more in their letters, official and otherwise, than in reports selected for annual publication. As for his first two volumes, Colonel Phillimore has examined the vast amount of unpublished material, sorted and sifted it, and then selected what is essential to give a connected story. After a summary narrative of the whole period, he devotes eight chapters to the topographical exploration and survey of the various regions and Presidencies—including the Mountain Provinces (Chapter III), the North-east Frontier (IV), and Burma (V). These are followed by four chapters on Revenue Surveys which were soon found necessary in the "Upper Provinces" of Bengal for land settlement at this period. The last sixteen chapters are more technical, and deal with astronomical and trigonometrical control, instruments, map reproduction, administration, pay and allowances of personnel, etc. They include two chapters (XVI and XVII) on the Great Trigonometrical Survey under Lambton and Everest. The body of the volume is followed by nearly a hundred pages of selected biographical notes, as valuable as those in the earlier volumes, and a full index.

Even the reader who has "mastered the gentle art of skipping," as suggested by the author in his preface, or the one who prefers dipping to bathing, will find much of absorbing interest in this formative period of British administration. This is partly because Phillimore's selection of documents is so good that they reveal the different characters of the actors, and even the change in their personalities as they grow older or become exhausted by illness. During the period wide tracts of unknown country were opened up to exploration and survey as a result of the Gurkha and Maratha wars and the Burmese war of 1824–6. The travels and surveys of W. S. Webb, J. A. Hodgson, and James Herbert—to mention three only of the pioneers of Himalayan exploration—who first observed the positions and heights of the great range, only to be ridiculed by geographers in England, are no less absorbing than the adventures of those who were now able to work freely in the jungles of Central India, or trace the course of the lower Irrawaddy, or begin the search for the Brahmaputra sources. As yet there was little knowledge of the course of the Tsangpo in Tibet except from d'Anville's map and from the missions of Bogle and Turner.

The publication of these records is of lasting historical interest. The edition is very small and few are likely to hear of it. Volume I is almost out of print. Many beautiful examples of the work of the old surveyors, in various styles, have now appeared in the three volumes. No expense or care has been spared in their reproduction which is highly creditable to the present staff of the Survey of India. Thanks to the perseverance of Colonel Phillimore, and to the cooperation of the Indian Government, the whole of the fine collection of original maps up to 1860 has now been transferred to the Indian Archives in New Delhi, where they are receiving specialist treatment for preservation. I look forward with keen anticipation to volumes IV and V, dealing with the departmental records when Sir George Everest and Sir Andrew Waugh were Surveyor Generals. During this period, from 1840 to 1861, the detailed survey, based on first-class triangulation, covered the Himalaya west of Nepal. K. M.

AFRICA

THE EQUATORIAL NILE PROJECT AND ITS EFFECTS ON THE ANGLO-EGYPTIAN SUDAN. Report of the Jonglei Investigation Team. 4 volumes and introductory volume. 13×8 *inches;* 1150 *pages; plates and* 249 *maps and diagrams. Issued in the summer of* 1955. 145*s*

The Team consisted of officials of the Sudan Government and the Report is produced by the Government. The Equatorial Nile Project is part of a scheme for the extension

of irrigation put forward in Volume VII of 'The Nile Basin' by Hurst, Black and Simaika (1946) at the request of the Egyptian Government, and was officially adopted as their policy. The Project includes storage reservoirs in Lakes Victoria and Albert and a Diversion Canal, known as the Jonglei Canal, to reduce the heavy losses of water in the swamps of the southern Sudan. The construction and working of this Project will inevitably produce great changes in the hydrological conditions of the upper White Nile and the surrounding country, with very considerable effects on the life of the people. The investigation of these effects and the measures which will be necessitated by the changes have led to a study of the modes of life of the peoples and the natural resources of a great part of the southern Sudan. Amongst the subjects studied are the hydrology, physiography and ecology of the region; the people and their habits; animal, grassland and crop husbandry and fisheries; the effects of the project in detail and the measures necessitated by these.

The authors very wisely have recorded all their observations so that the main part of the book is a work of reference. An introductory volume, however, summarizes the material collected and the conclusions therefrom.

The studies were carried out in country where work is difficult owing to a trying climate, poor communications due to the existence of large areas which are swampy in the rainy season and others which are waterless in the dry season, with in addition insect pests, some of which carry tropical diseases. The plates in the report illustrate some of these conditions; for example, the difficulty of surveying in the swamps.

The people in the area depend for their living mainly on cattle, supplemented by agriculture and fishing. Under present conditions in the rainy season the river rises and overflows its banks, and people and cattle are forced to move to their permanent villages on higher ground inland where they carry on rain cultivation. When the rains cease the river begins to fall, the country away from the river dries up and drinking water becomes scarce over large areas. Having harvested their crops people and cattle move back to the river banks, where the fall of the river has exposed good grazing on its flood plains. Food supplies are then supplemented by fishing.

The main effect of the Project will be to change the regime of the river to meet the needs of irrigation lower down, so that low levels will occur in flood time and high levels in the dry season. This will have direct effects on riverain grazing and on the fishing, and there will be secondary effects on people living away from the main stream. These have been examined as to their extent and as to the measures to be taken where losses of livelihood are inevitable, as in some of the grazing areas and fishing waters, to provide substitutes.

Volume II examines very fully the effects of the Project, and discusses counter measures which might be proposed. These include fuller use of natural pastures by provision of drinking water in the dry season, conservation of fodder, improvement of land by drainage, and the introduction of superior grasses. The question of irrigated pastures is also discussed. A chapter is devoted to improvement and expansion and cultivation by better methods, improved varieties of crops, enlargement of the cultivated areas, better tools and the use of animal power, and mechanization is also discussed. In the matter of improvement of grasses and crops experiments have been made which are described in Volume III.

A selection of counter measures from amongst those discussed which might be practicable is estimated to cost about 12 million pounds. The team considers, however, that modifications of the method of operation of the Project can be made which will lessen considerably the losses of grazing and fisheries. Their estimates for losses of riverain pasture in the operation of the Project as originally proposed and in their revised operation are 36 per cent. and 19 per cent. respectively, while the cost of the measures would be reduced by nearly a half. The possibility that modifications of the original scheme would be required to meet local conditions was foreseen by its authors and was mentioned in Volume VII of the Nile Basin. A modification with

such prospective advantages therefore merits careful consideration to see how it can be fitted into the general scheme of water conservation.

Matters of interest are the hydrological reconnaissance of the torrents which come down from the mountains bordering the plain east of the Bahr el Jebel, and also of those from Ethiopia which flow into the Machar Marsh north of the Sobat river. This last is interesting as being one of the pieces of Africa which has not yet been traversed, though the Sudan Survey Department has made maps from the photographs taken by the American Air Force, and the Team made an air reconnaissance and also one on foot. The Report contains practically all that is known about the hydrology and topography of the area.

It is impossible in a short notice to give an adequate account of what has been accomplished, but the Team are to be congratulated on a fine piece of work, which will be valuable not only in connection with the Equatorial Nile Project but also in the future development of the southern Sudan. H. E. H.

ECONOMIC GEOGRAPHY OF WEST AFRICA. By F. J. PEDLER. *London: Longmans, Green*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 232 pages; colour photographs.* 16*s*

West Africa still depends, as it did before the war, on exporting a limited range of industrial crops. Its commercial status has been enhanced in recent years by the fact that the world is ready to pay higher prices for cocoa and vegetable oils. This has helped the British colonies and protectorates, the "Four Countries" as Pedler calls them, to make rapid strides towards self-government and has allowed them to embark on ambitious development programmes. The French and Portuguese territories and Liberia are referred to in 'Economic geography of West Africa,' but the author is concerned mainly with Nigeria, the Gold Coast, Sierra Leone and the Gambia. The geographical background of the whole region's land, climate, soils, population, etc., is summarized in the first forty pages. The condensation is admirable except in a few places where controversial subjects are mentioned, such as the effects of forest on rainfall, and the practical importance of river capture. (See pages 14 and 15.)

The main part of the book includes not only the chapters on crops, minerals and transport one expects to find in an economic geography, but also carefully balanced discussions of several questions particularly important in West Africa; for example, the wisdom of government restrictions on the buying and selling of land in the interests of social stability, and the way indirect taxation continues to militate against the accumulation of capital in the hands of farmers growing crops for export. Whether he is considering the economic aspects of government or the reactions involved in the fluctuating demands for oil seeds and palm oil, the author's approach is clearly stated and well-informed. For the most part he is dealing with large economic units; countries and, in the case of Nigeria, regions. However, he has earlier made an economic study of northern Zaria, a province of northern Nigeria, and in the work under review he emphasizes the importance of local production for local consumption.

Only a page or two are devoted to the ill-fated enterprises of the Colonial Development Corporation. More consideration might have been given to the fundamental question of how the outmoded agricultural economies of West Africa are to keep pace with the ambitions of its governments for political and social development. However, the stated purpose of this book is not to point to solutions but "to present the facts and, by using the economist's system of analysis and reasoning, to establish the relationship of cause and effect in the work-a-day world of West Africa." In this, the author has succeeded remarkably, in view of the modest size of his book, and has produced a work of interest to many in Africa and this country. A. T. G.

ECONOMIC DEVELOPMENT IN RHODESIA AND NYASALAND. By C. H. THOMPSON and H. W. WOODRUFF. *London: Dennis Dobson*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 205 pages; map.* 18*s*

When Central African Federation was being debated, many statements about its economic advantages were made, especially by its protagonists, but few were sub-

stantiated by facts about the economic conditions of the proposed political grouping. This book's special value lies in its account of the resources and the economic problems of Northern and Southern Rhodesia and Nyasaland. The authors, government officials in the Federation, emphasize three fundamental needs—for capital, for immigrant skill and experience, and for the raising of the low productivity of the African. These needs are closely interrelated and their satisfaction must become a balanced process. The book tries to show how far the process has gone and the lines which future development seems likely to take.

A short description of the pre-war economy is followed by a discussion of wartime and subsequent developments in relation to the natural and human resources of the territories. These chapters, which include many references to publications that are not widely known outside Central Africa, are of particular value to geographers. The use of such resources is shown to depend not only upon government policy but also upon basic facilities such as transport, power and water supplies, and various social services. Attention is then directed in turn to agriculture, both European and African; to mining, which is dominated by copper in Northern Rhodesia in contrast to Southern Rhodesia, where asbestos, gold, chrome ore and coal all make substantial contributions; and to manufacturing industry, in which Southern Rhodesia alone is as yet of much economic significance.

The authors rightly emphasize that there must be a careful balancing between the provision of directly remunerative economic services and of those social services which, however necessary, may yield only a very indirect return. Federation, they conclude, "will allow existing Government capital resources to be employed to best advantage," but it is "not complete economic integration but a centralization of most economic powers." They do not expect Federation to bring about any spectacular improvement in the economy in the short run, but believe that it "may in due course be looked upon as a major step in promoting the further economic development of Central Africa." These are the authors' viewpoints, and they refer only to the economic, not the social and political, aspects of Federation. This objectively written book will provide readers with the essential background of economic facts against which they can for themselves judge the prospects of this new political unit.

R. W. S.

THE JOURNAL OF JAN VAN RIEBEECK. Edited by H. B. THOM for the Van Riebeeck Society. *Cape Town and Amsterdam: A. A. Balkema.* Vol. I, 1952, 395 *pages;* Vol. II, 1954, 406 *pages;* 10×7 *inches; illustrations and maps.* 100s *the set of three volumes*

These volumes were received in 1952 and 1955 respectively whilst a third remains to be published. A parallel set in Dutch is also appearing. They will present in print for the first time a complete rendering of the official journal maintained by Commander Jan van Riebeeck at the Dutch settlement at the Cape from its foundation in 1652 until 1662. A panel of translators has produced a faithful and lively English version of the original. Two editors have provided abundant philological and historical footnotes, and an index will accompany the third volume. Illustrations and maps complete this scholarly and well-produced work that was undertaken by the Van Riebeeck Society, Cape Town, as a contribution to the celebrations that marked the tercentenary in 1952 of the foundation of the settlement on the shores of Table Bay.

Here is the story of the genesis of Western civilization in South Africa, when a resolute band of one hundred and ten men and fifteen women and children laboured methodically under their indefatigable commander to secure their position and fulfil their purpose. This was to victual the ships of the Dutch East India Company, and to this end they undertook gardening and farming operations. A fort and jetty were built, a schoolmaster was appointed, the first free burghers were established on their own farms and slaves were imported. A recurrent theme is the impossibility of maintaining satisfactory relationships with the Hottentots who were the sole source of

livestock. Transactions with these unpredictable and often dishonest nomads were frequently the cause of friction, and much bloodshed was only averted because the Company's policy constrained the colonists to avoid violence at almost any cost. When Van Riebeeck left the Cape in 1662 his task had been well done, and the record of the settlement he founded has been one of continuous expansion. These volumes that embody his journal are an invaluable source book of enduring interest for all students of the history and geography of the Dutch colony at the Cape. V. S. F.

SÄLLSAMT LAND. By GÖSTA MOBERG. *Stockholm: Saxon and Lindstrom*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 286 *pages; maps and illustrations*

Nearly a century ago, there appeared a book by Count Goblet d'Alviella called 'Sahara and Lapland.' In recent years, Sweden has balanced an increasing interest in the Lapps by a growing interest in Africa. Among Swedes who embody the African enthusiasm is Gösta Moberg. 'Sällsamt Land,' written at the semi-popular level, is the saga of a lesser Swedish Kinglake who makes a journey through Saharan wastes to the Tibesti mountains. Even today, Gösta Moberg can lay fair claim to being "an officially credited ambassador to the desert world." A century ago, with such a flair for travelling, he might well have been a great explorer.

By wing, wheel and inevitably camel, Gösta Moberg makes his way through this "cold land with a burning sun." The curiosities of such tribes as the Matmata occupying their grotto settlement contrast with the seeming civilization of French outposts. Dune seas or the chaos of arid mountains embrace "forgotten valleys," "ghost oases," "forbidden cities," "secret wastelands," "terrorist tracts" and other places of likely appeal for the armchair traveller. The specialist—unless he be anthropologist who may be temporarily interested in the customs, costumes and daily life of the Toubous or archaeologist looking for widely scattered stone drawings—may find his appetite whetted more by the ethnographic collection assembled by the author (presumably, in part, to add to the treasure troves of Göteborg museum). The text is lifted to low peaks of excitement—when, for example, water supplies are exhausted and a sick guide lies between death and deliverance. This was, perforce, largely a journey without maps; because maps on a sufficiently large scale to be of value were not available. There is, however, no reason why maps showing the route followed should not be equal in quality to the production of the book. The photographs are good, sometimes memorable.

Today, one hears so much of Anglo-Africa—and so much of that from Anglo-African sources—that the vast territories belonging to other powers and principalities are neglected. Gösta Moberg travels without a political axe to grind; he is not the social or economic analyst. He is the civilized wanderer in a French wasteland.

W. R. M.

NORTH AND SOUTH AMERICA

CLIMATIC ATLAS OF THE UNITED STATES. By STEPHEN SARGENT VISHER. *Cambridge: Harvard University Press*, 1954. 12×8 *inches;* 403 *pages; charts and diagrams.* $9.00

Dr. Visher, professor of geography at Indiana University, has in this handsome compilation amassed 1031 maps and diagrams, many prepared by himself, giving general, regional and local statistics not only about climate itself but also its effects on health, agriculture and the like. These are interspersed with explanatory text and prefaced by an account of the major geographical factors controlling the climate of the United States, namely latitude, sea-coasts, mountains and lakes.

The climate is fundamentally continental, but the continentality is displaced by the prevailing westerly winds from the Pacific towards the Atlantic coast, is modified in the vicinity of the Great Lakes, and enhanced by the meridional trend of the Rockies and other mountain ranges, allowing "cold waves" and blizzards to sweep far south

from Arctic Canada, and "heat waves" to waft far northward from the tropical Gulf of Mexico.

The extent, indeed, to which all parts of the United States are subject to severe vicissitudes of temperature at all seasons is shown in some simple maps. One of these indicates that in every State the extreme maximum summer temperature has at some station exceeded 100° F., ranging from 104 in Vermont, New England, to 134 in California; another, similarly, that in every State the extreme winter minimum has passed below zero Fahr., ranging from −2 even in subtropical Florida to −68 in Montana (where 117 has been recorded in summer).

The coastal regions represented as climatically the least and most favourable are situated at opposite ends of the country, in the south-east and north-west respectively. The states bordering on the South Atlantic and Gulf of Mexico are hot, humid and enervating and subject to hurricanes, tornadoes and thunderstorms with their torrential rains. On the other hand, parts of Oregon and Washington are compared with the British Isles and described as exceptionally healthful "as revealed by the comparatively abundant energy of the people and their generally rather ruddy complexions."

There does not appear to be any explanation in the text of the anomalous summer climate of San Francisco which under Pacific influences is so chilly and foggy that notwithstanding extreme heat not very far inland its mean temperature actually rises from July to September. Presumably this is because the cooling down of the interior in the early autumn weakens the indraught from the Pacific Ocean allowing the coastal temperature to rise at a time when, moreover, the sea surface is a little warmer.

The volume, dedicated to the U.S. Weather Bureau officials, is adorned by a relief map of the United States from the U.S. Geological Survey. The map, is perhaps, rather too full of detail in relation to its scale for the eye to follow without embarrassment, at any rate in the western region of mountain and plateau. L. C. W. B.

FLOODS. By W. G. HOYT and W. B. LANGBEIN. *Princeton, New Jersey: University Press; London: Geoffrey Cumberlege*, 1955. 9½×6 *inches;* x+469 *pages; maps, illustrations and diagrams.* 60*s*

Floods are one of the most persistent of natural disasters, variously estimated to cause damage in the U.S.A. equivalent to 200 to 500 million dollars a year. Two officers of the U.S. Geological Survey have written this comprehensive account of the nature of floods in general, their occurrence in America and the problems of their control. The life history of a flood is described, with ample examples, from its origin as rain or snow melt to the causes of its subsequent extent and duration. From these studies the Corps of Engineers have obtained such essential data for each valley as the probable maximum and the probable likely flood to which their control works may be subjected. The flood forecast service of the U.S. Weather Bureau is a most economical method of minimizing damage and loss of life, but the complexity of the hydrological analysis involved, not always appreciated by the public, is described. The advantages and limitations of control by reservoirs, levées, dams, channel improvements and spillways are discussed, the author suggesting that, whatever other advantages may occur, the control of run-off by contour ploughing, afforestation, etc., has little effect in diminishing floods. The most important message of the book is that the flood plain "belongs to the river" and floods are a natural hazard which must be faced by those using such areas. The extent of liability to flood in any area is being discovered with increasing definition and when buildings are located on a hazardous site, there seems, therefore, little reason for relief by charity when a disaster occurs. The loss is a foreseeable risk which should be borne by insurance. The premiums charged would adjust economic advantage to the risks inherent in the location and would discourage building on unsuitable sites. Unhappily the American insurance companies are still unwilling to insure against flood damage. Private house owners are usually unaware of the flood risk and they might be protected by zoning ordinances prohibiting

building in dangerous areas. The political and legal implications for America of flood control are discussed and the last half of the book is devoted to details of the problems of each drainage basin, the schemes in operation and plan, and a history of all major floods which have been recorded since 1543. There is a useful bibliography and numerous maps, diagrams and photographs. This is a valuable monographic study by professional specialists of a dramatic aspect of the relationship of man and his environment. W. T. W. M.

LA NATURALEZA EN LA AMERICA ECUATORIAL. By VITOLD DE SZYSZLO. *Lima: Sanmarki y cia*, 1955. 10×6½ *inches;* 328 *pages; illustrations*

"Amazonía . . . Un país encantado . . ." are Vitold de Szyszlo's opening words. Clearly to write about equatorial America is for him a labour of love and the result is a very old-fashioned book, but none the less good, packed with every sort of information about the natural history of the region. The first part describes the journeys made by the author since 1944, although, it should be noted, his experience of the country goes back to 1904. The second presents geological, botanical and zoological information, some of it of considerable ingenuity, such as the lists of plants containing alkaloids of specific effects. The third part is given over to information of an economic nature, such as lists of plants yielding gums, fibres and resins. As a reference book it will be invaluable and the unsophisticated travel diaries give a faithful picture of the country. A few maps interspersed with the text would have helped and, in the scientific section, especially where authorities are named, a reference to the source of the information would have been a distinct service to those interested in enquiring further into the biological problems mentioned. P. B.

AUSTRALIA

CANBERRA: A Nation's Capital. Edited by H. L. WHITE. *Sydney and London: Angus and Robertson*, 1954. 8½×5½ *inches;* 243 *pages; maps and plates.* 35*s*

In this composite work of nearly twenty contributors, under the editorship of the Librarian of the Commonwealth National Library, a comprehensive account is given not only of the early history of Canberra but of its present character. It is still only forty years since Canberra was conceived, but it has already passed through the stages of birth and infancy as the "bush capital" and is maturing as a city which now has a population of about thirty thousand.

Part I recounts the story of the developments that led to the establishment of Canberra as Federal Capital in 1927. Its pre-urban antecedents are dealt with in an admirably succinct account by L. F. Fitzhardinge of exploration and early settlement in the district during the nineteenth century. Part II, in which the geology and geomorphology, climate, soils, vegetation and fauna of the Capital Territory are in turn described by experts, deals with the wider setting, and in Part III attention is focused upon the urban area itself. H. W. King's chapter on the site and morphology of the city is an illuminating analysis of the way in which Canberra has emerged from a planner's concept into a reality. The adaptation of the plan to the terrain, with successive modifications of the original design, some of them deliberate, others the product of natural developments that attended the emergence of the functioning city, is clearly expounded. Professor Spate contributes a useful final chapter on the social structure and function of the capital city.

The book as a whole does not altogether overcome the inherent difficulty of building a diversity of contributions into a unified whole. Part II in particular lacks the integration and selective appraisal of the elements of the setting that might have been provided by a geographer's presentation of the material here left in the hands of specialists. Even Part III, where the role of the geographer is more evident, suffers from some degree of disjointedness as a collection of the work of four authors.

A feature of the work is the wealth of illustration. More than sixty half-tone plates,

assembled at the end of the volume, effectively portray the emergence of the city in its setting and its present appearance, and various aspects of the Capital Territory are presented in a valuable collection of maps that are provided in an accompanying folder. A. E. S.

POLAR

GEOGRAPHY OF THE NORTHLANDS. Edited by G. H. T. KIMBLE and D. GOOD. American Geographical Society: Special Publication No. 32. *New York: American Geographical Society and John Wiley; London: Chapman and Hall*, 1955. 9×5½ *inches;* x+534 *pages; maps and illustrations.* 84*s*

So many people have found out such great quantities of new facts about the Arctic in the last decade or two that we are in danger of being overcome by their numbers and learning nothing from them; of failing to see the wood for the trees. In many spheres of arctic research it is assessment of known facts rather than acquisition of new ones that is important. That reason alone is enough to justify a welcome for this book. Fourteen contributors, all with sound qualifications and some with more than that, have outlined the present state of knowledge of the Arctic and sub-Arctic in five hundred pages. The result is, of course, a highly compressed account; more especially since the book includes studies both by subject and by region. But the editors have taken this decision with their eyes open, and on the whole, in spite of inevitable repetition, they are justified.

The systematic chapters are on physiography, seas and sea ice, meteorology, plant and animal life, population (usefully divided into aboriginal and immigrant), transport, natural resources, and political and strategic aspects. In the regional section, there is a chapter each on Alaska, Greenland, Iceland, Svalbard and northern Scandinavia; northern Canada is allowed three chapters and the U.S.S.R. six. The boundaries of Arctic and sub-Arctic used in the book are based on summer isotherms, and they serve well. The sub-Arctic quite correctly includes much of Ontario and Quebec, most of Newfoundland, and almost all the U.S.S.R. north of the Trans-Siberian railway. Thus the population of the "northlands" as here defined is not a handful of natives and traders, but some thirty-seven million people.

There is no space here for detailed comment. Let it be said that the editors have done well in obtaining a uniform degree of compression in the various contributions; but one feels that Scandinavians might well have been asked to write the four chapters on Scandinavian territories. Most of the many maps are excellent, but it is a pity that place-names have been anglicized. The whole work shows every sign of careful preparation, is handsomely produced, and seems to be remarkably free of factual errors. It deserves to take its place as the nearest approach there can yet be to a general textbook on the Arctic. T. E. A.

DEUTSCHE ANTARKTISCHE EXPEDITION 1938–39: Wissenschaftliche Ergebnisse. DIE NEUBEARBEITUNG DER ÜBERSICHTSKARTE DES ARBEITSGEBIETES DER EXPEDITION. By H. P. KOSACK. DIE WETTERVERHÄLTNISSE WÄHREND DER EXPEDITION UND DIE ERGEBNISSE DER METEOROLOGISCHEN MESSUNGEN. By H. REGULA. *Hamburg: Geographisch-Kartographische Anstalt "Mundus:" Helmut Striedick*, 1955. 9½×7 *inches;* 310 *pages; text-figures and map. DM.*27.80

Hr. Kosack has compiled a 1/1,500,000 map of western Dronning Maud Land in which he incorporates the surveys of the Norwegian–British–Swedish Antarctic Expedition, 1949–52. The map purports to show the position of the ice front in 1939, and for this reason some of the work of the later expedition is rejected. The result is deplorable. An ice rise in long. 4° W. is shown between 250-metre and 500-metre isobaths, a situation which is virtually impossible. The disappearance of the feature between 1939 and 1952 is compensated by the most rapid expansion of an inland ice sheet nearby. Changes as great as the map suggests do not take place in so short a period. Source material is fully acknowledged but frequently ignored. The

250-metre isobath passes over a point at which *Norsel* sounded no bottom at 1200 metres. Apart from deliberate discrepancies, careless draughtsmanship serves to displace points by up to 9 kilometres. It is quite clear that no reliance can be placed on the map to the west of long. 2° E. It will be some years before anyone is in a position to criticize Kosack's representation of the eastern half of the area, where construction is from air photographs with no ground control. But the rest of the map utters a palpable warning.

The Norwegian–British–Swedish expedition found that the height of the land was between 800 and 1400 metres lower than was shown by the 1939 edition of the German map. Kosack attributes these errors to inexperience of the aircrews and to hurried construction of the map resulting in perfunctory use of the data obtained. He claims to have anticipated, in a map published in 1951, the discovery of the errors. But the new map shows a further gross scaling down of spot heights, with the result that his remark "Die Ergebnisse der Norwegisch–Britisch–Schwedischen Expedition stützen meine Berechnungen" savours of plagiarism. Another extremely ill-advised step has been to retain the original German names on nunataks whose longitude has been "adjusted" anything up to 4½°! It is true to say that the map is a great improvement on the earlier edition. But no other commendation can be justified.

The second section of the report discusses some of the meteorological work of the expedition, and contains a weather map in which Graham Land is portrayed as a group of islands. C. W. M. S.

SON OF THE NORTH. By CHARLES CAMSELL. *Toronto: The Ryerson Press*, 1954. 8½×5½ *inches; 244 pages; maps and plates.* $5.12

Charles Camsell was born in 1876 at the fur trading post of Fort Liard, near the point where the boundaries of British Columbia, the Northwest Territories and Yukon Territory now meet. His father was an officer in the Hudson's Bay Company and ten of his eleven children were born at trading posts 2000 miles from a doctor, where mails came twice a year and supplies only once. At the age of eight Charles joined his elder brothers at school in Winnipeg, and in the next twenty years spent a total of two with his parents. In 1894 he graduated from the University of Manitoba and later took post-graduate studies at Queen's University, Harvard and the Massachusetts Institute of Technology in Boston. He joined the Geological Survey of Canada in 1904, and was appointed Deputy Minister of Mines in 1920 and Deputy Minister of the Department of Mines, Interior, Immigration and Indian Affairs in 1935; in 1924 he was appointed to the Council of the Northwest Territories, and was Commissioner from 1935 to 1946. He was awarded the Founder's Medal of the Society in 1945. Such are the bare bones of a life that few could fail to envy, for, until he became chained to an office chair, Charles Camsell spent each summer, and many winters, surveying and exploring in the remote parts of northern Canada. He travelled on foot, by canoe, scow and aeroplane, with large parties but more often with one or two companions, as a prospector in the Klondyke gold rush and as a geologist for the Canadian government. Fortunately he both writes and selects his material with equal skill; with unusual modesty he ends his story in 1918, and condenses the record of a distinguished public career into five brief pages. 'Son of the North' is consequently an eminently readable book by a man who, as the Prime Minister of Canada writes in the preface, "had direct personal knowledge of every important development in Northern Canada in the twentieth century." The book is illustrated by well chosen photographs and has adequate maps. L. M. F.

PACIFIC

ADAM IN PLUMES. By COLIN SIMPSON. *Sydney and London: Angus Robertson*, 1955. 9¼×6 *inches;* xvii+268 *pages; maps and illustrations.* 21*s*

This is the volume on the discovery and present state of the central highlands of New Guinea which was promised by the author in his last book, 'Adam with arrows.'

It is a more straightforward account than the previous work and, therefore, a better book. One could still wish something less superficial to do justice to the facts but it is churlish to ask more of an author than he intends. Simpson brings to the general reader a cohesive record of the opening to civilization of the last great section of the earth to be discovered by the West. He has drawn upon the personal accounts and the diaries of the Leahys, who were the first to enter the Highlands, in 1933; of later discoverers and representatives of government, and of missionaries. He has obviously read, and quotes from, the works of the few anthropologists who have worked in the region. His own visits provide local colour, and there is a section on birds of paradise. The book ends with attention to the faunal station at Nondugl and the introduction of sheep, both of which enterprises are due to Sir Edward Hallstrom. Considerable effort has obviously gone into making the record full and accurate. If there is superficiality, one senses that it is not personal. The fault lies with the long-established practices of our civilization. Here is new knowledge on a scale which we will never face again short of interplanetary space. Instead of seeking it out in the fullest possible manner for the enrichment of our concepts, we are satisfied to administer the territory. The preliminaries of that process have begun. Whatever the end may be, our aim is clear: to reduce the unknown to a comfortable mediocrity. Or is this reviewer asking too much? At any rate, if you have not yet succumbed to the fascination of the Highlands, this book with its excellent pictures is the best place to begin.

M. W. S.

PHYSICAL AND HUMAN GEOGRAPHY

THE LIMITS OF THE EARTH. By FAIRFIELD OSBORN. *London: Faber and Faber*, 1954. $8\frac{1}{2} \times 5$ *inches; 175 pages. 12s 6d*

Following his somewhat dramatic exposition on the wastage of world resources in 'Our plundered planet,' Mr. Fairfield Osborn has produced another volume on the now perennial topic of food and population. Much of the book is devoted to a survey of food resources treated either country by country or area by area, e.g. South Africa, the Amazon Basin. In general the assessment of food supplies is soundly based on two paramount considerations, firstly the condition of each community as regards economic, social and political circumstances and secondly, the natural environment, specifically the conditions of climate, relief, soil and water supply. In this way the variations in output, productivity and potential expansion in different parts of the world are depicted with sober emphasis. Having adopted this approach, it is unfortunate that the result is rather unbalanced for there is only brief reference to Egypt and scarcely any to Japan, two of the most over-populated countries. Little is said of China, while a footnote on page 120 explains that fuller attention is given to Russia in the author's earlier book.

Mr. Osborn also considers the possibility of utilizing new sources of nutriment such as the reserves of oceanic plant and animal material as well as synthetic foods. This section provides an informative summary, suitably cautious in tone, of experimental work undertaken to date on such items as the *chlorella* algae and yeasts as a basis of protein production.

Though hardly to be ranked among the neo-Malthusians, the author states plainly the urgency of the problem of sustaining a continually increasing population and casts permissible doubts on many of the measures frequently advocated for extending food production. It is in this sense that he discerns the limits of the earth and the problem as being largely one of time. The book is particularly readable and includes within its small compass an extremely wide range of topics. Many of these are not pursued far and the specialist may justifiably claim that their treatment is inadequate, but to the general reader this saves the book from being tedious. In any case a selected bibliography is given for each chapter. The work is one of real merit in that such a complex subject is handled so comprehensively and yet so concisely.

K. C. E.

THE SOCIETY'S NEWS

APPLICATIONS FOR GRANTS FOR EXPLORATION AND RESEARCH, 1956

Applications for grants must reach the Director and Secretary not later than **1 March 1956**; it is only in very exceptional circumstances that late applications can be considered. Applications should state (*a*) their scheme of research or scientific programme; (*b*) the names, number and qualifications of members of the party; (*c*) length of time to be spent in the field; (*d*) total estimated cost; (*e*) names of other institutions to which they have applied for help; (*f*) the amount of the grant, and any other assistance, that they request. Applications should be accompanied by two letters from qualified institutions or individuals supporting the proposed expedition of research. All applications must be typed. Leaders of expeditions and applicants for grants will be expected to attend an interviewing board.

RETIREMENT OF MR. MARCEL AUROUSSEAU

Mr. Marcel Aurousseau retired from the Secretaryship of the Permanent Committee on Geographical Names in June 1955, after nearly twenty years' tenure of that post. He succeeded Mr. J. H. Reynolds, the first Secretary, on the latter's death in 1937. Mr. Aurousseau was then working in the Society's Library, and had acquired a remarkable knowledge of its contents, which he subsequently turned to good use. This is not the place to assess his long and immensely valuable services to the P.C.G.N., but it is fitting to acknowledge his readiness to advise and assist members of the staff and other enquirers, not only on place-names, but on most aspects of geography. His scholarly papers and reviews in this *Journal* will be well known to readers. His friends and colleagues at the Society wish him and his wife many happy and active years on their return to Australia next year.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Sir Miles Clifford, who has had a long and varied career in the Colonial Service, returned last year from the Falkland Islands, which he had administered since 1948; he is on the Committee of Management of the Trans-Antarctic Expedition, and a member of the Society's Council. *Dr. E. B. Worthington* organized the scientific services of the East Africa High Commission, prepared the Development Plan for Uganda, and in 1951 became Secretary-general of the Scientific Council for Africa south of the Sahara. *Academician A. A. Grigoryev* has published articles in the *Journal* in 1952 and 1953; he is a medallist of the Russian Geographical Society and holds the post of Director of the Geographical Institution of the Academy of Sciences. *Professor A. H. Robinson* is Professor of Geography and Chairman of the Department of Geography in the University of Wisconsin; during the Second World War he was Chief of the Map Division, O.S.S. *Professor D. L. Linton* is Professor of Geography and Head of Department in the University of Sheffield; he received the Society's Murchison Grant in 1942. *A. A. L. Caesar* is a Lecturer in Geography at Cambridge, and a Fellow of St. Catharine's College. *Professor Hilgard O'Reilly Sternberg* is Professor of Geography in the University of Brazil, and Secretary to the Organizing Committee of the 18th International Geographical Congress to be

held next year in Rio de Janeiro. *J. P. Cole*, a graduate of Nottingham, is now Assistant Lecturer in Geography at Reading University. *Tracy Philipps* has for five years taken part in the scientific administration of the Belgian African National Parks, having been nominated British member of the Research Institute by decree of H.M. the King of the Belgians.

UNIVERSITY NEWS

EAST BENGAL (EAST PAKISTAN) UNIVERSITIES

The Department of Geography at Dacca University and the study of geography in East Bengal have made commendable progress since the partition of India in 1947. From its inception as a small undergraduate department on the establishment of Pakistan it has grown into a full fledged post graduate and Honours school with facilities for research leading to M.A. and PH.D. degrees. Altogether there are now seventy students on various courses. Women are fairly represented in all classes.

The visit of Professor L. Dudley Stamp in February 1955 under the auspices of the British Council and his lectures and friendly advice have been extremely stimulating. Professor Stamp was also called upon to inaugurate the East Bengal Geographical Society and he has cemented his contact with this area by becoming patron of the Society.

The staff of the department has been expanded and some of its members have gained useful foreign experience. Dr. Nafis Ahmad has been Reader and Head since 1948. In 1951 he went to the London School of Economics and obtained a PH.D. degree on "Economic Geography of East Bengal (East Pakistan)," which was accepted for publication in full and the Oxford University Press (Pakistan) are publishing it in London. Dr. Ahmad visited most British university departments of geography, went as Pakistan delegate to the I.G.U. meeting in Washington D.C. in 1952, and later saw the working of geography departments in several continental universities such as Copenhagen, Stockholm, Bergen, Madrid, Vienna, Zürich, Rome and Istanbul. His extensive travel was made possible by generous grants from the British Council and the Nuffield Foundation. Dr. A. I. H. Rizvi, lecturer in the department, is interested in deltas and worked for his doctorate on comparative studies of the Ganges and Mississippi deltas in the State University Louisiana, U.S.A., under Professor J. Russell. Mr. A. H. Siddiqui did economic geography specialization for his M.A. at the London School of Economics. Mr. S. H. H. Naqui, M.B. (Carolina U.S.A.) and Mr. F. K. Khan have interests in the agricultural geography of Pakistan.

A feature of the last two sessions has been the development of research on East Bengal, and fields receiving attention include land use studies, rural settlements, economic geography, river problems, agricultural geography, forest resources and transport. Several papers have been written by staff members on these topics and some have been published. Field work for land use and settlement studies has been extended to many parts of Dacca district and annual excursions lasting for several days have been organized. Areas already visited include the Sundarban forest, South Sylhet tea garden region, and parts of Chittagong Hill Tracts.

A post graduate department of geography has been started at the new University of Rajshahi, Mr. A. M. Patel, M.A. (London), who was formerly a lecturer in the geography department at Dacca University, has been appointed Reader. Two more lecturers have been appointed to assist him. N. A.

INTERNATIONAL GEOGRAPHICAL CONGRESS 1956

The Organizing Committee of the 18th International Congress at Rio has published the following information: "Starting on November 1st, there will be a special international news broadcast, over the short-wave station of the Ministry of Education (PRL 2, PRL 8, and PRL 4, respectively 17.875, 11.950 and 9.770 Kilocycles) featuring the 18th International Geographical Congress. The programme will be on the air

at 9.30 p.m., Greenwich Mean Time, on the first and fifteenth of every month. In addition to general information regarding the Congress, the programme may carry answers to requests for information, etc. We hope it will contribute to 'tie in' geographers the world over with the preparatory activities of their Congress."

Those interested in the Congress may like to know that the Royal Geographical Society is being kept closely in touch with arrangements by Professor Hilgard O'Reilly Sternberg, Executive Secretary of the National Committee; a list of papers already proposed by foreign geographers, as at September 1, is on its way and will be referred to in the next issue of the *Geographical Journal*.

DAVID LIVINGSTONE CENTENARY 1855–1955

This year marks the centenary of the arrival at the Victoria Falls, on 16 November 1855, of David Livingstone, the first white man to set eyes upon Mosi-oa-tunya, or "the smoke that thunders." In this sense only did the explorer make a "discovery," for the Falls were well known to the local people, Barotse and Makololo, who cherished traditional tales of a "tremendous monster . . . that will catch a canoe and hold it motionless in spite of the efforts of the paddlers." The natives knew of prayers, and of powerful "medicine" to calm the angry waters, and they took Livingstone to a tiny island on the very lip of the Falls. Ever fascinated by water, the explorer observed, on his second visit to the scene on 9 August 1860, how "pieces of water leap off in the form of comets, with tails streaming behind, till the whole snowy sheet becomes myriads of rushing, leaping, aqueous comets." The naming of the Falls after his Queen was for Livingstone a departure from habit: his contemporaries readily commemorated the Royal family, their own homes, their companions and their fancies in the names they gave to African hills, rivers and lakes, but when Livingstone named the Victoria Falls and carved his initials with the date on a tree, he did two things he had never done before in Africa.

We have received from Mr. C. G. Reedon Rodway, Federal Tourist Officer at Livingstone, an account of the Centenary Celebrations, which were planned to last throughout June, July and August of this year, and to culminate in a Day of Commemoration at the Falls on November 16 when a monument was unveiled on Livingstone's "Garden Island." On June 1 the David Livingstone Centenary Exhibition was opened by the Mayor of Livingstone, after a formal introduction by the Provincial Commissioner, Mr. G. C. R. Clay, who is Chairman of the Board of Trustees of the Rhodes–Livingstone Museum. Also on the platform were Dr. Desmond Clark, Museum Curator, and Mr. George Baldwin, Chairman of the Celebrations Committee. During six months' vacation leave in Britain, Dr. Clark collected a number of interesting relics of the explorer for display, some of them lent by institutions and individuals especially for the Exhibition. A number of things were lent from the Society's museum, including a clasp knife, mirror, pen and prayerbook belonging to Livingstone, and brought back from Africa by E. D. Young in 1868, a sextant used by him in Central Africa, and the boat's compass used on the Zambesi in 1856. A replica was made of the section of the "Livingstone tree" which stands in the Society's museum, and this was placed in the centre of one of the showcases devoted to "The Last Journey."

The Exhibition, which was open throughout the celebrations, was housed in a large corrugated iron building, the steelwork of which was used in the Rhodes Centenary Exhibition in Bulawayo in 1953. The lay-out was in three sections: the foyer, the main hall, and the cinema; films of local interest were presented and also "The life of Livingstone," a silent film resuscitated for the Centenary. A large map stood in the foyer depicting in coloured lights the great journeys in southern and central Africa, and beyond, in the main hall, nine large showcases were arranged to trace the explorer's life and career.

A number of social, cultural and sporting events took place during the three months of celebrations, and from July 22 to 28 the Pan-African Congress on Prehistory met

at the Victoria Hall at Livingstone. This was the first international congress to be held in either of the Rhodesias, and about one hundred delegates attended at the invitation of the Northern Rhodesia Government. The Congress meets approximately every four years, and is the main coordinating body for prehistoric research in the African continent. The first Congress was held in 1947 at Nairobi, the second at Algiers in 1952. A small open-air museum was opened at the Victorial Falls while the Congress was in session, including a specially excavated area to expose the old land surfaces in the vicinity of the Falls. Lying on the surfaces on which they were found are the prehistoric tools of the particular cultures, and so it is possible for visitors to see at a glance half a million years of local history. Livingstone's contribution to African history is thus placed in a perspective he would have understood better than anyone.

THE MEETING OF THE BRITISH ASSOCIATION, 1955

Once again Bristol proved to be a happy meeting place for the British Association. Members who had attended the last meeting held in the City, as long ago as 1930, declared that the efforts of the local authorities on behalf of the Association were even more successful than on the previous occasion. In particular, the arrangements made by the City and the University were eminently satisfactory to the three thousand members present.

Section E, under the able presidency of Mr. J. N. L. Baker, were fortunate in the accommodation provided by the School of Geography and is particularly indebted to Professor W. W. Jervis, always a staunch B.A. man, whose experience of the 1930 meeting enabled him to anticipate the section's requirements admirably. Not only did he place the resources of his Department at our disposal but he also obtained the use of an excellent lecture theatre for the reading of our papers. Behind the scenes, he worked tirelessly on behalf of all sections as Chairman of the Excursions Sub-Committee. He was also responsible for the valuable exhibition of local maps.

The first day of the sectional activities was, as usual, devoted to local geography. Professor Jervis set the stage for later papers in his lecture on "The City of Bristol in its geographical setting." This was followed by "Recent changes in the economic geography of Bristol," by Mr. F. Walker and "Climatic fluctuations in Bristol," by Dr. F. G. Hannell. The reading of Mr. O. D. Kendall's paper on "The geomorphology of the Bristol district" was deferred until the Friday afternoon. During the Thursday afternoon, two excursions were made to the docks at Avonmouth, where senior officials of the Port Authority were excellent guides, and several groups were conducted by members of the School of Geography on short walking tours of the city.

The Friday session was opened by Mr. J. W. Birch with a paper entitled "Two aspects of pioneering in Canada" in which he summarized the research he had made during a recent visit to North America. This was followed by Mr. Baker's presidential address on "Geography and its history" in which he traced, in a most scholarly manner, the development of our subject. As he made abundantly clear, modern geography has a long and honourable history and is now accepted as an academic discipline. His address, already printed in *The Advancement of Science* (Vol. 12, No. 46), is worthy of close study by geographers and many others. During the afternoon, Mr. Kendall's paper was followed by that of Professor S. W. Wooldridge on "Some problems of the physiography of the Bristol district in the light of the physical history of south-east England" which enabled the author to relate the results of his studies in the Bristol area to those of his previous work, with Professor D. L. Linton, which have been recently re-issued in "Structure, surface and drainage in south-east England." The day's proceedings were concluded by a paper of a different character in which Professor Malcolm Proudfoot, an overseas guest, examined the fragmented administrative structure of Chicago.

Saturday and Sunday were taken up by excursions in the traditional style of Section E. All-day visits to areas as far apart as Exmoor, the Mendips, the Wye

Valley, the Vale of Wiltshire and the Somerset coast and levels were arranged as well as shorter excursions in the neighbourhood of Bristol. So attractive and informative were these carefully organized tours that some members found difficulty in making their selection but none were disappointed finally.

The Monday programme provided further evidence of the breadth of geographers' interests. Professor Niels Nielsen of Copenhagen opened with a paper on "The organization of geographical researches in northern Sleswig" and was followed by two contributions to physical geography—"The glacial succession in Essex and the associated morphological features" by Mr. K. Clayton and "The erosional significance of cyclic bevelling in a savana landscape" by Mr. J. C. Pugh. It was unfortunate that Professor Varley was recalled to West Africa and so was unable to read his afternoon paper on "The zonation of vegetation and rainfall in the Gold Coast." Dr. J. B. Tait gave an account of his researches into the quantitative assessment of the varying strength of the so-called "Gulf Stream" to the north-west of the British Isles, and Mr. Kingdon-Ward spoke on "Sino-Himalaya and the distribution of plants in South-east Asia."

Tuesday morning was given over to historical geography. Professor A. A. Davies examined the problem of the last voyage of John Cabot, a topic appropriate to a Bristol meeting, Mr. G. B. G. Bull discussed the conclusions he has reached as a result of discovering a previously unknown map of land utilization in the London area in 1800 by Thomas Milne, and Mr. D. J. M. Hooson spoke on "The rise and fall of the Chiltern straw industry during the nineteenth century." In the afternoon, Miss H. C. Chew's paper on "Some major changes in regional types of farming in England and Wales from the 1930s to the 1950s" and that of Dr. R. H. Osborne on "Internal migrations in England and Wales, 1951" revealed the character and form of detailed research work which is being conducted by some of our younger geographers.

The final session on Wednesday morning was shared by three members of the British North Greenland Expedition, Dr. C. Bull, Mr. H. Lister and Mr. P. J. Wylie, who read papers on aspects of the ice conditions in those parts of Greenland which they had visited. They provided an excellent conclusion to the sectional proceedings as their large audience enthusiastically indicated.

It is impossible to do justice to all the papers in a short report of this kind. Some of them will probably appear in journals or elsewhere when it will be seen that the Association remains successful in its policy of presenting opportunities for the advancement of science. Equally impossible is it to express our full appreciation of the efforts of all those who did so much to make the meeting pleasant and successful. Reference has already been made to Professor Jervis and his colleagues, but special note should be made of the whole-hearted work of the local secretary, Mr. J. W. Birch. In addition to reading a most interesting paper and leading an excellent excursion, he arranged a splendid sectional dinner and, with the help of a group of students, he was responsible for the detailed organization of the meeting.

Next year's meeting will be held at Sheffield when Professor A. A. Miller will preside over the proceedings of Section E. The other officers for 1956 are Recorder: Dr. M. J. Wise; Secretaries: Professor F. J. Monkhouse and Mr. J. W. Birch. A preliminary request for offers of papers has already been sent to University Departments of Geography but other offers should be made immediately to the Recorder, Dr. M. J. Wise, London School of Economics, Houghton Street, Aldwych, W.C.2

A. E. M.

NATURAL RESOURCES, FOOD AND POPULATION IN INTER-TROPICAL AFRICA

A geographical symposium on natural resources, food and population in inter-tropical Africa was held at Makerere College, the University College of East Africa, from 10 to 17 September 1955. It was sponsored by the International Geographical

Union and received generous financial support from the United Nations Educational, Scientific and Cultural Organization. The Executive Committee of the Union met at Makerere during the conference and its President, Professor L. Dudley Stamp, was chairman of the symposium. All but two members of the committee were able to attend, and all played an active part in the sessions of the conference. Public lectures were given to African, Asian and European audiences at Makerere, Entebbe and Jinja by Professors Stamp, H. Boesch (Zürich), G. B. Cressey (Syracuse) and G. Kuriyan (Madras).

Those attending the symposium included representatives of the departments of geography in the University College of the Gold Coast; University College, Ibadan; the University College of Khartoum; Fourah Bay College, Sierra Leone; and the Institut des Hautes Études, Dakar. There were also geographers from the Universities of Bristol, Oxford, Syracuse and Malaya, the Institut Français d'Afrique Noire at Dakar, and the Department of Soil and Land Use Survey, Gold Coast. These, together with members of the staff and student body of Makerere College, and with several geographers and other officers working in various government departments in Kenya and Uganda, gave a total membership of between forty and fifty.

The first two days were devoted to lectures and excursions covering the area around Makerere, including a most valuable introduction to the regional geography of Buganda by Professor S. J. K. Baker and an informal talk about the College by the Principal, B. de Bunsen. On succeeding days papers dealing with French West Africa, Nigeria, the Gold Coast, Sierra Leone, Portuguese Guinea and the Sudan were read and discussed, and a session was devoted to the special problems of the World Land Use Survey in tropical Africa. Local excursions were arranged into the Kampala district and a whole-day excursion visited the Owen Falls Power Scheme on the Victoria Nile at Jinja and the Indian-owned sugar-estate at Madhvaninagar. Visits were also made to the Mpanga Forest Station and to the Empire Cotton Growing Corporation's research station at Namulonge. The Government of Uganda held a reception for the members of the symposium. Much help and hospitality was also given privately by officials and other residents of Kampala and Entebbe.

At the end of the symposium, twenty-two members and five Makerere students joined in a five-day excursion of some 600 miles into the Western Province of Uganda, under the guidance of Professor Baker and the staff of the Department of Geography. The party was given an excellent picture of the geographical diversity of the western Rift Valley of East Africa and enjoyed two days in the Queen Elizabeth National Park, to which they were welcomed by the Director, Mr. R. M. Bere. Members were fortunate enough to see the snowfields of the Ruwenzori range from the shores of Lake Edward. Visits were made to the salt industry of Lake Katwe, the fishery station at Kasenyi on Lake George, and the copper-mining centre of Kilembe, to which a new railway is being built from Kampala.

The symposium was a new venture for the I.G.U. and was the first time that so many geographers in tropical Africa had been able to meet together. It is hoped that it may be possible to repeat this very worthwhile experiment before too long. The success of the conference depended on the cooperation of a great many people. Special thanks are due to the Chairman, Professor Stamp; to the Secretary-Treasurer of the I.G.U., Dr. G. H. T. Kimble; to the Principal and Council of Makerere College; to the Warden and staff of the hostel, Mary Stuart Hall, where all the visiting members stayed; and to many officials of the Government of Uganda. Above all, the conference is indebted to the team-work and thoughtfulness of Professor Baker and his colleagues, Messrs. D. N. McMaster, B. W. Langlands, A. Shepherd and S. H. Ominde. For months before, and continuously during, the conference they devoted themselves to the comfort, entertainment and enlightenment of their guests. Those who were privileged to be present at this Makerere symposium have the happiest memories of their stay in Uganda and the highest regard for their colleagues in the University College of East Africa.

R. W. S.

RECENT BIO-GEOGRAPHIC DISCOVERY IN AFRICA

Another scientific expedition, coordinated by an ecologist, has recently returned from a methodical exploration of another of the integral Reserves of the Belgian African National Parks, the Garamba. The distinctiveness of these national parks consists in their dedication to scientific research by their founder, King Albert. Thanks to the progress with this long-term programme, faithfully followed up by Dr. Victor van Straelen, President of the relative Research Institute, the areas of Africa in which are situated these Reserves, carefully chosen between Rhodesia and the Sudan, have become scientifically the best known parts of equatorial Africa.

The two latest explorations, in the Garamba and the Albert Reserves bordering respectively the Sudan and British East Africa, have produced two bio-geographic discoveries. They are discoveries in the sense of disengaging from hitherto unnoticed geographic facts their true significance.

In pursuance of the programme of scientific research in the areas it administers, the Belgian Institute of African National Parks last year despatched two geologists to the Ruwenzori area. Their main mission was a scientific reconnaissance of the northern part of the massif of the so-called "Mountains of the Moon." They were to report on the possibilities of access for an eventual exploration of this area.

This side of the vast massif is little known. Indeed, there are parts of it into which no European has ever penetrated. Given the exceptionally difficult conditions of access, the tangled density of the equatorial rain-forest which here covers the lower slopes of Ruwenzori, the severe climatic conditions with sudden successions of heat and cold, and the local superstitions surrounding it, it is a real no-man's-land into which the surrounding human populations do not venture; in short, a true virgin land. During their reconnaissance, the geolgists de Heinzelin and Berce recognized the existence of mountain lakes of which the presence in this isolation was quite unknown.

Anxious to seize the opportunity offered in these areas left free from human influence, the Parks Research Institute is this year planning to organize a scientific expedition, cooperating with the Pasteur Institute of Paris, with the object of collecting microscopic bacteria which are anaerobic and are needed for important research projects. The collection has to be effected in conditions of complete asepsis, and therefore to be carried out by a specialist. The anaerobic organisms thus collected will be carried by 'plane to Paris in specially conditioned packing, to maintain the stock at very low temperature. Biological surroundings wholly free from all pollution by man are extremely rare, and it is hoped promptly to utilize scientifically the discovery of this group of hidden lakes in this virgin area of Ruwenzori.

The Garamba Reserve bordering the western section of the Congo–Nile Divide is situated geo-botanically in a borderland where the Sudanic meets the Guinean. Recalling a certain specific similarity between the fish of the Congo and the Nile, which may arise from previous connections between these two vast river systems, Henri de Saeger, leader of the recent expedition to the Garamba, records a most interesting bio-geographic discovery not, I think, previously placed on record. Along this east–west section of the slightly raised Congo–Nile Divide, roughly at 29° 50′ E. by 4° 20′ N., there are, on either side of the Divide, streams rising in depressions roughly corresponding with each other, as if they had been separated only by a slight forcing-up of the present ground between. Mr. de Saeger cites, as an instance, the continuity of the *thalweg* of one of the heads of the Atlantic-affluent river Moko on the Congo side with one of the heads of the river Tori on the Sudan slope close by. The Tori runs north into the Mediterranean by the Nile. Between the adjacent heads of these two north–south and south–north rivers, the geological movement which now separates the two basins can, continues Mr. de Saeger, be clearly seen. In this undulation of the Divide, rocks emerge which are metamorphic, inclined at 45 degrees and stripped by erosion. Here the east–west Divide, flanked by a small hill on each side, shows a north–south col or depression. In the depression is a marsh fed by the rains running from the two small hills each side of it. During the rainy season and in the

terrific dry-season thunderstorms, the marsh overflows in both senses, down both the Congo and the Nilotic slopes. The slight scarp separating the present sources of the two streams does not now allow of the passage of fish from one basin to the other. But the time is not perhaps distant when it was so.

In similarly arid savannah land further south, the writer of this note has observed the dry-season running of fish, chiefly *siluridae*, far up dry long-grassy depressions swept by a torrent of an hour's duration, without the existence of eventual water or any marsh which could have in itself provided a known or natural objective. But are we yet fully aware of the nature of the urge which draws English eels to the Sargasso to reproduce life or the land-lemmings periodically to swim out *en masse* to death at sea? In this case, the torrents are not seasonal flood-backs from swollen rivers. They come, on the contrary, from high ground after those thunder cloud-bursts which are such a frightening feature along the eroded outcrops of this section of the Congo–Nile Divide. The remarkable thing is the promptness and speed with which fish from a shrunken river will rush over momentarily submerged grass up ancient and now grassy water-courses. They thus find themselves stranded in mass in parched Bush, or in the case cited by Mr. de Saeger, perhaps sometimes in a common Congo–Nilotic swamp. Whatever true significance can be disengaged from these observations, the biogeographic discoveries of this Belgian Research Institute, which so courteously consults and associates this country, present a remarkable interest.

TRACY PHILIPPS

CRUISE OF THE *MISCHIEF*

The *R.A. Regimental News* for August 1955 reports the departure on June 21, from Lymington for Patagonia, of the ex-Bristol pilot cutter *Mischief*, owned and skippered by Major H. W. Tilman and flying the ensign of the Royal Artillery Yacht Club. The *Mischief* has a crew of five, including Major E. H. Marriott, late R.A., and Lieutenant M. R. Grove, a serving officer on special leave. A letter has been received from Major Tilman headed "At sea: S. lat. 11°, W. long. 34° 50′, Sept. 8th" in which the following account of the expedition's progress is given: ". . . We are some 50 miles off the coast of Brazil and 150 miles south of Pernambuco. It is nine weeks since we left Falmouth, six weeks since Las Palmas, our last port of call. The only land we have seen since was the C. Verde Is. and we hope not to see any until near Montevideo. This is still 1500 miles away and we may get there early in October. The S.E. trades are not blowing as they should, being light and fickle and too much from the south. Conditions have been easy and pleasant so far. The crew are being well fed—at least I think they are—and the ration of water of ½ gal per man for all purposes seems ample. We collected 30 gals of rain water in the doldrums. Could have collected 300 had we had empty tanks. Fish are scarce. We have caught only one bonito, very good eating, and harpooned a dolphin. His meat is rather too rich and in any case it is a shame to harm such friendly playful creatures. The only bait that seems acceptable is flying fish and unless these oblige by coming on board, as frequently they do, one is without bait." According to the original plan of the cruise, the *Mischief* was due at Punta Arenas in November, and it was hoped after that to explore the little-known mountain region in the west of Patagonia.

MAN'S USE OF THE EARTH: AN INTERNATIONAL SYMPOSIUM

An international symposium on "Man's role in changing the face of the earth" was held in Princeton, New Jersey, U.S.A., on 16–22 June 1955. The Wenner-Gren Foundation for Anthropological Research was the organizing body and the results will be published by the University of Chicago Press through a grant in aid of publication from the National Science Foundation. The plan was originated by the Wenner-Gren Foundation and developed by the co-chairmen: Marston Bates, Lewis Mumford and Carl O. Sauer. The theme was intended to provide a basis for exploration of the question: What has been, and is, happening to the earth's surface as a

result of man's having been on it for a long time, increasing in numbers and skills unevenly, at different places and times? It was felt that this subject was basic for obtaining perspective on the story of mankind.

The symposium provided a focus of interest for persons with different theoretical and descriptive backgrounds. It attempted to survey the state of knowledge on a topic touched only in piecemeal fashion by individual disciplines, and emphasis was placed, as in many recent Wenner-Gren symposiums, on the stimulation of cross-disciplinary thought. The general topics of the fifty-three papers suggest the scope of the conference: (i) *Retrospect:* man's tenure on the earth; through the corridors of time; (ii) *Process:* man's impact on the sea; changes in water economy; soil and slope changes through human use; modifications of biotic communities; ecology of wastes; urban-industrial demands on the land; (iii) *Prospect:* limitations of the earth; and the rôle of man.

The papers were circulated beforehand and the sessions of three hours' each were devoted to discussion. Participation was by invitation only and included seventeen persons from outside the United States: Professor A. Leslie Banks, University of Cambridge; Professor H. C. Darby, University College, London; Dr. F. Fraser Darling, University of Edinburgh; Sir Charles G. Darwin; Professor E. Estyn Evans, Queen's University; Mr. Artur Glikson-Aran, Ministry of Labour, Israel; Dr. Pierre Gourou, University of Brussels; Mr. Michael Graham, Director of Fishery Research in England and Wales; Dr. E. A. Gutkind, London; Dr. Fritz M. Heichelheim, University of Toronto; Dr. J. A. Hislop, University of Cambridge; Professor Soliman Huzayyin, University of Cairo; Dr. Edavaleth K. Janaki Ammal, Central Botanical Laboratory of India; Dr. Radhakamal Mukerjee, University of Lucknow; Professor Gottfried Pfeifer, University of Heidelberg; Professor Hermann von Wissmann, University of Tübingen; and Dr. Karl Narr, University of Göttingen.

M. W. S.

THE SAND DUNE AREAS OF THE NORTH-WEST AND KIMBERLEY DIVISIONS OF WESTERN AUSTRALIA

We have received the following note from Lord Rennell of Rodd in which he introduces some new information on the sand dunes of Western Australia.

In the course of flying over some of the northern districts of Western Australia four years ago, I was particularly struck by a field of widely spaced and apparently (from the air) consolidated parallel dunes in the area south-east of Broome, that is to say south of the southern flank of the Fitzroy River basin and east of the Eighty Mile Beach on the coast between Port Hedland and Broome. From the air this dune field of considerable extension looked interesting by reason of the wide spacing of the flat bottoms between the dune crests, their relatively low altitudes compared with their spacing and their uniform and more or less parallel trend. Unfortunately, I was never able to visit this dune field, nor could I collect any local information. The area is extremely waterless and inhospitable, and has rarely been visited or traversed in recent years. Even the Canning Stock Route seems today as little known as it is used.

In the early part of this year I was fortunate enough to meet some of the senior staff of, or attached to, WAPET, the Western Australian company which is drilling for oil in the Exmouth Gulf area, on the coast between Carnarvon and Roebourne. I also flew up to the drilling camp at Learmonth on Exmouth Gulf where under the direction of staff from the Caltex Corporation, the company is conducting an extensive boring programme combined with widespread geological and geophysical work along the Western Australian coast roughly between Geraldton and Derby.

Among other areas where this field work is being done is the Canning Basin which includes the dune field which I had seen from the air. From these contacts I was able to receive the brief account which is printed below. I am personally much obliged to Mr. G. M. Cunningham of the Caltex Corporation, the senior geologist in this

West Australian enterprise, and Mr. D. J. Guppy, the author of the article, for permission to publish this account in the *Journal*.

I have only to add that the extreme difficulty presented by the terrain almost precludes further detailed exploration even by modern four-wheel-drive trucks without the help of helicopters, which may have to be brought into use in the future work which is contemplated. The sharp crest lines of the dunes present considerable obstacles in crossing from one inter-dune bottom to another. The near-parallelism of the dune formations involves penetration into very long culs-de-sac with even sharper crests to traverse at the junction of two dune lines than at points further west which may involve retracing tracks for several tens of miles. RENNELL

MR. GUPPY writes: One of the striking features of the State of Western Australia is the wide distribution of surface sand, particularly in the coastal districts where sediments of a sandy nature were deposited. Of special interest are the sand-dune areas developed in the two major sedimentary basins: the Carnarvon Basin (in the vicinity of the Tropic of Capricorn) and Canning Basin (south-east of Broome). These large dune areas, particularly in the Canning Basin, have provided a long standing challenge to exploration.

North-west Division: Unlike the Canning Basin the dunes in the area north and south of Carnarvon have a scattered distribution at the present time. The distribution can be explained by a combination of erosion of the dunes in a 12-inch rainfall area, and restricted source areas for the sand. Two distinct dune trends exist, east–west in the inland areas and north–south along the coastal strip. Without exception the dunes are the fixed *seif* type and maintain a vegetation cover of low scrub or spinifex.

A consistent feature of the dunes is a steeper southern flank on east–west dunes and a steeper western flank on the north–south dunes. The crest lines of the dunes are frequently eroded to form a hollow or series of saddles which in effect create a double or triple crest on what is normally a simple seif dune. With the help of aerial photographs these complex crest areas can be avoided during cross-country vehicle travel. Caliche has been found on a number of occasions on the slopes of the dunes in the Carnarvon Basin. This is a local surface effect and can be accounted for by the lime content of the source rocks.

Little information is available on the dunes in the area but it is estimated that the average height would be around 60 feet. Much larger dunes have been observed on the highway south of Carnarvon and appear to reach a height of around 150 feet. The dune areas of the Carnarvon Basin are by no means indicative of desert conditions. The often thick cover of native grasses and scrubby trees provides vegetation for a profitable sheep-raising industry.

Canning (Desert) Basin: The Canning Basin coincides with the area known as the Great Sandy Desert and has stood as a major barrier to exploration from the early days of settlement to the present day. In the late nineteenth century and in the early part of this century, explorers were attempting to penetrate this inhospitable area extending over 100,000 square miles. The introduction in 1875 of camels and Afghan keepers by Colonel Warburton was a major advance, and permitted the first crossing from east to west to be made. Colonel Warburton's epic trip was a model for later attempts, all of which followed the same pattern of extraordinary hardship usually mixed with tragedy. Apart from the physical hardships occasioned by lack of food and water, bitter clashes occurred between the explorers and the desert aboriginals with consequent loss of life. Since the early part of the century, little ground reconnaissance has been attempted and it is only in the last few years that geological parties have begun feeling their way into the interior of the desert from the west coast. Small tribes of desert aboriginals still inhabit this vast area but are very rarely encountered. For practicable purposes the area is uninhabited and attacks by wandering aboriginals are now only a historical memory.

The main difference between the Great Sandy Desert and the better known deserts

such as the Sahara, lies in the ever present vegetation on the fixed *seif* sand dunes. Towards the coast, with a rainfall of between 10 and 18 inches, patches of thick low scrub occur. Inland the scrub is more sporadic and is eventually limited to low clumps of the hardy perennial Triodia (commonly called spinifex) which occurs on both the dunes and the inter-dune areas. The dune trends are E.N.E. with local variations and the dune spacing varies from several miles from crest to crest to a very close spacing. Single dunes can be followed for tens of miles and range in height from an average around 60 feet to a maximum exceeding 120 feet in the eastern and south-eastern part of the desert.

Apart from a line of wells along the Canning Stock Route across the eastern margin of the basin, water is a critical problem and is limited to natural springs and native soaks. The springs and soaks are frequently indicated by aboriginal relics such as shells, bones, nuts, etc., but are so widely spaced and poorly known that they do not provide reliable sources of water supply.

Recent vehicle traverses into the area have been made with limited success. The very long distances involved and the high petrol consumption require large quantities of fuel and water. The spinifex clumps in the sand result in the roughest riding conditions imaginable and even with sand tyres the rough surface conditions limit progress to 20–40 miles a day. Experience has shown that dunes exceeding about 40 feet in height cannot be crossed by Power Wagons without some preparatory work on the sand dune. The dune sands of the Canning Basin have abundant source material in the Mesozoic sandstone which underlies a large part of the desert area.

It is undoubtedly fortunate that the dunes have an east–west trend which permits traverses to be made from the coastal tract inland between the dunes to a range controlled by fuel and water supply. North–south traverses across the dune trend introduces problems which for the moment cannot be readily overcome where long traverse distances are involved.

D. J. GUPPY

SOVIET GEOGRAPHICAL SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIA) OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.: GEOGRAPHICAL SERIES, 1955. No. 3 (May–June). Report on the Second Congress of the Geographical Society of the U.S.S.R. Condition and tasks of Soviet geography at the present stage of its development by I. P. Gerasimov. Fundamentals of socialist production and the tasks of economic geography by V. F. Vasiutin. Voyage to Franz-Josefs-Land by G. A. Avsiuk. Basic characteristics of the structure of the Niemen valley by A. B. Basalikas. Geography in the Rumanian Peoples Republic by K. Herbst. Toponymy

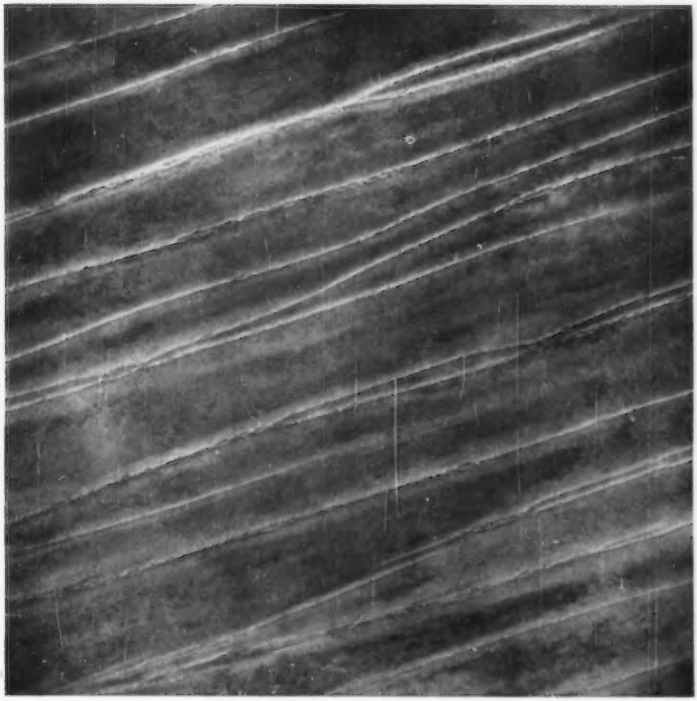

Photo: R.A.A.F.

Typical dune formation in Canning Basin, from the air (scale 1 inch to 1½ miles)

Woods Hill: Mesozoic sandstone outcrops, with lines of dunes

in Rumania by B. V. Pagirev. The most important geographical works of ancient China by V. T. Zaichikov.

BULLETIN (IZVESTIA) OF THE ALL-UNION GEOGRAPHICAL SOCIETY, LENINGRAD, Vol. 87 (1955). No. 3 (May–June). The physical character of regions of virgin soil in the Altai area by G. V. Zanin and V. D. Alexandrova. Geographical distribution of cultivated flora by A. I. Kuptsov. Basic types of mountain ranges in the U.S.S.R. by K. V. Staniukovich. Contemporary world atlases, with special reference to the Soviet 'World atlas' by A. G. Isachenko. The history and present state of economic geography studies in the U.S.S.R. by O. A. Konstantinov. Origins and types of natural boundaries by D. L. Armand. The principles of the classification of climate by A. A. Borisov.

Vol. 87. No. 4. July–August 1955. Geography in the Moscow university by N. A. Gvozdetskii. Glaciation of the Muz-Kol massif by R. D. Zabirov. First archaeological findings in the Lower Amur by A. P. Okladnikov. Zoogeography of the Siberian highlands by E. M. Vorontsov. Contemporary problems of the economic regionalization of the U.S.S.R. by O. A. Kibalchich. Report on the committee on transcription of geographical names (Leningrad, March 9–11, 1955).

ROYAL SOCIETY ANTARCTIC EXPEDITION

Arrangements are being made for the M.V. *Tottan* (540 tons) to sail from Southampton on 22 November for Antarctica, carrying the ten men who form the advance party of the Royal Society International Geophysical Year Antarctic Expedition. Their main object is to prepare for the installation of a scientific research station on the Antarctic mainland, on the shores of the Weddell Sea, and in close proximity to the Weddell Sea base of the Trans-Antarctic Expedition. The *Tottan* was used previously by the British North Greenland Expedition (1952–54) and will sail via the Cape Verde Islands, Rio de Janeiro and South Georgia. The station will be one of twenty-two International Geophysical Stations being set up on the Antarctic mainland itself by the Commonwealth, the United States of America, Russia and other countries. The pilot scientific programme for this year's expedition includes surface meteorological measurements, ionospheric research, auroral studies, measurements of atmospheric ozone and glaciological observations. The party will send back reports on the operation of the equipment in the extreme cold to guide the preparations for the main expedition in 1957. The advance party will return in April 1957. The Royal Society has been associated with Antarctic expeditions for nearly two centuries, from the time of Cook. In conjunction with the R.G.S., it sponsored Scott's expedition of 1901, and in the first and second International Polar Years (1882 and 1932) the Royal Society was responsible for maintaining the Arctic Station at Fort Rae, Canada.

CORRECTION: GENERAL ATMOSPHERIC CIRCULATION AND WEATHER VARIATIONS IN THE ANTARCTIC

In the map on p. 335 of the *Journal* for September 1955 the island of South Georgia is misplaced.

NOTES

The ARCTIC INSTITUTE OF NORTH AMERICA is offering research grants in 1956 for scientific investigations dealing with the arctic and subarctic regions. Application forms may be obtained from: Arctic Institute of North America, 3485 University Street, Montreal 2, P.Q., Canada, or 1530 P Street N.W., Washington 5, D.C., U.S.A., and applications should be sent in as soon as possible. The INSTITUTE is also in a position to award grants from a sum of money provided by the Trustees of the Banting Fund primarily to encourage Canadians, particularly recent graduates, in northern studies. Enquiries should be addressed to: T. H. Manning, 37, Linden Terrace, Ottawa 1, Ont. Canada.

* * *

The Government of Ceylon has recently set up a Commission to enquire into and report on the law and the administrative arrangements relating to the alienation and use of Crown Land. MR. B. H. FARMER, Lecturer in Geography at Cambridge, has been appointed to serve on this Commission and is now in Ceylon. Mr. Farmer lectured to the Society in January 1953 on "Problems of land use in the Dry Zone of Ceylon," and was awarded the Gill Memorial prize for the year in recognition of his work in this field.

* * *

The ROYAL CENTRAL ASIAN SOCIETY'S Lawrence Memorial Medal for 1954 has been awarded to Mr. Wilfred Thesiger, D.S.O., for his journeys among the Arabs and in the marshes of southern 'Iraq; the medal was received by Mrs. R. Astley, Mr. Thesiger's mother, at the Annual Dinner of the R.C.A.S. earlier this year. The same Society's Sir Percy Sykes' Medal for 1954 goes to Mademoiselle Ella Maillart for her work and travels on the borders of India and Nepal.

* * *

As part of the celebrations at Florence of the 500th anniversary of the birth of AMERIGO VESPUCCI, an extensive exhibition was held in the Palazzo Vecchio from June 1954 to September 1955. The exhibits were very comprehensive, and included original documents on Vespucci's career, early printed accounts of his voyages, and contemporary charts, maps and atlases, printed and engraved. The carefully annotated and illustrated catalogue of this "Mostra Vespucciana," compiled by Dr. Guiseppe Sergio Martini, will be of permanent value to students of geographical exploration.

OBITUARY

SIR CHARLES RAYMOND BEAZLEY, D.LITT.

1868–1955

Sir Raymond Beazley, who died in February 1955, at the age of eighty-six, was Professor of History in Birmingham University from 1909 to 1933. In his early days he specialized in the history of exploration and of geographical thought, and his great work: 'The dawn of modern geography,' published between 1897 and 1906, has recently been reprinted.

While holding a history fellowship at Merton College, Oxford, Beazley was elected in 1894 to the annual geographical studentship awarded jointly by the University and the Royal Geographical Society. He was then at work on a life of Prince Henry the

Navigator, subsequently published in 1895, the first of numerous studies in the history of exploration. In collaboration with Edgar Prestage, he edited a translation of Azurara's chronicle of Guinea for the Hakluyt Society, 1896–8. Later, he came upon a hitherto unexamined manuscript of John de Plano Carpini, which he also edited, as an extra publication, for the Hakluyt Society (1903). For his contributions to the history of geography, the Society awarded him the Gill Memorial in 1907. Two years later, he was appointed to the chair of history at Birmingham, and thenceforward his work lay mainly in the field of Russian history, though he did not neglect the geographical background. He was Ilchester Lecturer in Russian history, Oxford, in 1913, and also lectured extensively in the United States and Germany. Beazley became a Fellow of the Society in 1893, and served on the Council from 1919 to 1923.

To geographers, his name will be principally associated with 'The dawn of modern geography.' This monumental work deals authoritatively with the history of geographical exploration and science from the fourth century to the beginnings of overseas expansion in the early fifteenth century. Of particular value are the chapters on the history of medieval cartography, still the only comprehensive and detailed treatment in English. G. R. C.

CALOUSTE S. GULBENKIAN

1869–1955

By the death of Calouste S. Glubenkian on 20 July 1955, at the age of eighty-six, the Society has lost one of its senior members, for he had been a Fellow since 13 May 1889. He was one of the great pioneers of oil development in the Middle East, and even as a young man published a book and wrote several articles looking to a future when petroleum would be one of the world's main sources of power.

Gulbenkian was born at Scutari, the son of a prosperous Armenian merchant, and became a student at King's College, London, where he graduated with distinction from the department of engineering and applied sciences as an associate of the College in 1887. He then travelled in the Middle East, and after a visit to the Baku oilfields, became impressed with the possibilities of the industry, and by the end of the century had become one of its leading authorities. It is curious that in these years he was offered, and refused as too speculative, the oil concession which was later taken over by the Anglo-Persian Oil Company, and bought by William Knox D'Arcy about 1900. Subsequently Gulbenkian became Financial and Economic Adviser to the Turkish Embassies in London and Paris and a director of the National Bank of Turkey. By skilful negotiations between international oil and financial interests, he amassed an immense fortune, commonly reputed to be in the neighbourhood of £300,000,000, but a too persistent enquirer as to the amount of money he possessed received the somewhat enigmatic reply: "One day a few millions less, one day a few millions more." Gulbenkian also became one of the leading art collectors of the world, and his remarkable collection of European paintings was on loan to the National Gallery in London from 1936–50. As a philanthropist he avoided publicity as far as possible, but he was a generous contributor to all kinds of charitable organizations and also to people of all nationalities. The greater part of his estate has been left towards the creation of the Gulbenkian Foundation, details of which have not yet been made public, but which will probably turn out to be the most magnificent charitable trust ever established. E. H.

EMMANUEL DE MARTONNE

1873–1955

Emmanuel de Martonne has been a leader among geographers for many years, his studies ranging from physical geography to regional synthesis. He was born at Chabris (Indre) in 1873 and, after university studies, he taught geography successively in the faculties of Rennes, Lyon and Paris, in which last he became professor

and director of the Institut de Géographie, which was greatly developed during his term of office.

A distinguished student of his famous father-in-law, Paul Vidal de la Blache, he chose to specialize on the physical side of geography. A noteworthy event in this connection was his participation in the unique North American trans-continental excursion of 1912, and he contributed to the Memorial Volume (American Geographical Society, New York, 1915) a morphological interpretation of the Yellowstone National Park. This held the field for several years, but was ultimately superseded as further observations accumulated. Already at that time he was studying land forms in the Carpathians and Romania, and contributed articles on these topics to the *Geographical Review*, and also lectured in New York in 1916 as Visiting Professor at Columbia University. He returned to the U.S.A. at the end of the First World War to expound French life. Though not a linguist he made courageous attempts to lecture and speak publicly in English.

De Martonne's most widely known work is the great 'Traité de géographie physique' (Paris, 1st edition 1909, 7th edition 1948–), expanded into three volumes, and it has become a standard reference book in several countries thanks to its encyclopaedic character, which expresses its author's concern to cover every aspect of the work of "external" forces acting upon and altering the earth's surface. The earlier 'Géographie physique' of de Lapparent had included valuable studies of the influence of geological agents in moulding the surface, but this field of research, thanks to the genius of Suess and to de Margerie's careful work, has become the almost independent science of geomorphology, and into that realm de Martonne did not enter very far. On the other hand, he made a great deal of the influence of biological agents in the various regions of our globe, without trespassing into botany or zoology. He had in his mind a clear notion of the limits of physical geography as he understood the subject.

Late in life, Vidal de la Blache planned the great 'Nouvelle géographie universelle,' and de Martonne took an active part in the realization of this vast scheme. He became responsible for two large volumes on "Europe centrale." Almost inevitably, an author dealing with the lands that have become the satellite-dependencies of the Soviet Union must expect to meet divergences of value-judgments, but it may be said that de Martonne tried to keep prejudices under control, and his intimate experience of the Carpathians and their peoples gave special value to several of his chapters.

De Martonne showed his organizing power not only in the development of the Institut de Géographie but in a still wider field in connection with the Union Géographique Internationale. At the 1928 congress at Cambridge he was one of the chief guests from the European continent, and, after it, he studied land forms in Wales, having many discussions with Douglas Johnson and the Polish veteran Professor Romer. At the 1931 Paris congress he was Honorary Secretary. His firm insistence on official recognition of delegates from each state, and the careful preparation of guide books for each excursion planned by the congress, show his deep concern for the seriousness of the meeting. He was anxious to differentiate geographical study from more or less educated tourism, and was afraid of cranks. He retained the Secretaryship for Warsaw (1934) and for Amsterdam (1938). At Lisbon (1949) his long devotion was appropriately recognized by his election as Honorary President for life.

De Martonne did much of his research in fields outside his own country, but he was a leader in the publication of a collection of photographic illustrations of French scenery. It has been widely appreciated but could have had still more value had it been planned as illustrations to Vidal de la Blache's classic 'Tableau de la géographie de la France,' as that famous work had appeared before book illustration had attained the facilities gained as the twentieth century progressed.

Monsieur de Martonne was elected in 1932 to the Académie des Sciences; he received the Cullum medal of the American Geographical Society in 1939 and the

Victoria Medal of our Royal Geographical Society in 1950. He died in July 1955, at the age of eighty-two years. H. J. F.

HERBERT SHAW

1864–1955

Herbert Shaw, for thirty years Secretary of the Newcastle and Gateshead Chamber of Commerce, died at Warkworth on September 2 at the age of ninety-one. Over much of his life a major interest had been in geographical matters and he played a prominent part in the former Tyneside Geographical Society. This Society, which celebrated its Jubilee in 1937, was founded by a group of "quaysiders," men actively engaged in the expanding commercial life of the area. The Society published a Journal, established a Geographical Institute in Newcastle and organized lectures. The Society's Visitors Book contains the signatures of men and women whose contributions have been outstanding and the presence of many of them in the Tyneside area was due to Herbert Shaw's initiative and awareness. He was, as Honorary Secretary, the mainstay of the Society for much of its life history. When the shadow of the Second World War fell Herbert Shaw recognized what might well happen and thus it was that an arrangement was made with the Newcastle Division of the University of Durham whereby an annual commemorative lecture entitled the Tyneside Geographical Society lecture is now given together with an annual prize. He found great pleasure in these gatherings and it was a sad blow to him that he was unable to attend the last within his lifetime. Herbert Shaw's interests and activities were wide and varied. He was responsible for the collection of the money to establish the present Faculty of Economic Studies in the University of Durham. He served the City of Newcastle and the County of Northumberland in many important capacities. A devout man, his standards were high yet he could be surprisingly tolerant of many recent developments, so foreign to his own time and upbringing. Courteous, kindly and determined, he was a great friend of many geographers yet readily critical if their writings failed to be comprehensible to the layman. He will be much missed on Tyneside but it is good to know that he found life so satisfying in those long and happy years of retirement at Warkworth. G. H. J. D.

CORRESPONDENCE

The Medieval Defences of Aden

On reading Messrs. Norris' and Penhey's interesting account of the development of Aden's defences, I was reminded that in 1940 there was a series of postcards on sale in Aden, showing various phases in the capture of the city by the British in January 1839. I still possess a set of these cards which appear to be water-colour drawings by a certain Captain Rundle, R.N., about whom it would no doubt be possible to obtain certain biographical notes, but I have never come across any references as to the present location of these paintings, whether they be in possession of a public institution such as the National Maritime Museum, Greenwich, or some place in Bombay. These paintings are not in the Aden Museum.

The Rundle paintings show the single tower mentioned by Lieutenant Wellsted on Ṣīrah Island. From the picture I should judge the tower to have stood on the island's northern tip. It seems to have been loop-holed and battlemented, possibly consisting of a ground floor, one storey, and a flat roof, and no doubt it guarded the only accessible route from the present-day factory lying at sea level. A third card

shows a general view of the attack on the foreshore of Aden, with a large arch to the left of the picture and the towers, perhaps enclosing a gate, in the centre. On each side of the two towers is a line of Arabs with firearms. In the background can be seen two minarets, and at least two not at all inconsiderable buildings, one probably corresponding to the palace-like structure in Captain Cornwall's map published in 1782. A fourth postcard shows the surrender of the defenders of Aden, evidently Bedouin, armed with the long flint- or match-locks which may still be found sometimes in the Protectorates. This surrender is shown as taking place by a square tower and its location could no doubt be determined by reference to the official account of the action and a survey of the ground.

An early little known siege of Aden took place in the early twelfth century and an account of it has been published by Professor S. D. Goitein ("Two Eye-Witness Reports on an Expedition of the Kings of Kīsh," *Bull. Sch. orient. Stud. Lond. Univ.* **16**, 2 (1954) 247–57), but there is no precise information about the fortifications in it. Regarding the forts on Shamsān mountain I have come across a reference in a medieval manuscript history of the Yemen which alludes to the fact that Fort (Ḥuṣn) Shamsān was delivered to al-Mujāhid in 728 H. (A.D. 1327–8). If this is a reference to the fortifications on the summit of the mountain it would give them a pre-Turkish dating. In a Milan Arabic MS. composed in A.D. 1412–13 and dealing with the fiscal organization of Aden, only two gates are mentioned, the Bāb al-Barr, or Land-Gate, and the Bāb al-Sāhil, or Coast-Gate, though this does not imply that other gates did not exist.

R. B. SERJEANT

School of Oriental Studies, W.C.1

21 July 1955

HARBOUR ENTRANCES OF POOLE, CHRISTCHURCH AND PAGHAM

The correspondence which followed my paper (*Geogr. J.* **121**, 1 (1955) and *Geogr. J.* **121**, 3 (1953) raises some interesting points. From a comparison with other areas which exhibit two spits trending in opposite directions, Mr. W. V. Lewis has suggested that the mode of formation as outlined for these three South Coast harbours is probably unique and does not occur elsewhere in the British Isles, especially where larger harbour entrances exist. In seeking to explain this difference, it is worthwhile considering that at Poole and Christchurch the tidal conditions are abnormal. Due to the degenerate amphidromic system in this part of the English Channel both these harbours experience a relatively small tidal oscillation. Even during the spring tide period the tidal range is only 5·4 feet at Poole and 4·5 feet at Christchurch; at neaps it is very much less. This tidal pattern means that the amount of water entering and leaving the harbour embayment is very much less than one would normally expect with the result that the two enclosing spits can exist with only a very narrow gap between them. In addition, the depth of water offshore does not change greatly throughout the whole tidal period. With these differing conditions, the shoreline processes, which occur for example in the Glaslyn Estuary quoted by Mr. W. V. Lewis, are unlikely to be exactly reproduced at Poole and Christchurch. This may account for the unique shoreline development which has occurred in the latter areas although clearly the question requires further investigation.

Mr. A. Shepherd in his letter has drawn attention to the ironstone quarrying at Hengistbury Head and its possible effect on shoreline evolution at the entrance to Christchurch Harbour. In this he has followed the 1885 Report of the British Association Committee where similar views were expressed by the Reverend G. H. West. Ironstone extraction, particularly the removal of the inter-tidal reef, undoubtedly led to changes in the supply of material available for longshore drifting around the headland and this in turn may have influenced the initial growth of the southern spit and the formation of the Run. The maps covering the crucial period 1800 to 1870 are so few in number that only a general outline of the stages of shoreline evolution for the first part of the nineteenth century emerges. For this reason I feel

that no firm conclusion on this point can be drawn from the cartographic evidence although there may be a lot of truth in the suggestion.

As regards the recent changes, while it is true that the groyne to the south of Hengistbury Head has acted as a sand-trap, it has not prevented the spit from lengthening in the last two years. In January 1954 the buoyed entrance channel into the harbour lay opposite the new promenade and quay at Mudeford. In September of this year mapping of the spit disclosed that the entrance had moved 750 feet to the east and now lay opposite the house called Sandhills. In addition, there were a number of isolated drying banks lying off the Beach Cafe at Friars Cliff. It seems, therefore, that there is sufficient material lying just offshore available for lengthening the spit once again. Whether this will happen and thus re-create the feature which last existed before the gale of February 1935, only the next few years will show.

A. H. W. ROBINSON

Geography Department,
University College,
Leicester,
6 October 1955.

PEDIMENT LAND FORMS IN LITTLE NAMAQUALAND

Mr. W. V. Lewis has referred (*Geogr. J.* **121** (1955) 385) to my confusion of water action and mass movement in my remarks on desert mountain slope retreat; my intention, in fact, was to indicate their combined operation. Study of such slopes leaves no doubt that their angles are "boulder controlled," but it is my experience that mass movement *sensu stricto* accounts for a small part only of the removal of material from the slope face. The processes involved appear to resemble what Kirk Bryan once termed "gully gravure" (*J. Geomorph.* **3** (1940) 89–107). Secondary weathering products around the parent boulders are removed by hill wash and rill wash, and any resultant change of slope angle is followed by localized mass movement and some redistribution of the armour of slope boulders, whereby locally over-steepened slopes are protected while readjustment can take place elsewhere.

With regard to Mr. Lewis's second query, I would emphasize the following points which do not appear consonant with the view that lack of channelling on the upper part of pediments simply reflects a lack of ability to cut downwards.

(*a*) Dispersed flow on unchannelled pediments *is* able to cut downwards as revealed by the effective current regrading of these rock-cut surfaces.

(*b*) Linear flow exists in some measure on the hillslopes and to a general degree on the lower parts of pediments; one must account for dispersed run-off in an intervening zone of intermediate slope angle.

(*c*) The width of the unchannelled zone decreases with the supply of rock waste to it.

I employed the term "channelling" to distinguish the mode of run-off; marked stream incision was not implied.

J. A. MABBUTT

Department of Geography,
University of Cape Town,
22 August 1955

MEETINGS: SESSION 1954–55

Meeting of 18 July 1955. The President in the Chair

Election to Fellowship: Miss E. M. Baddelly; Miss R. M. Ballaster, B.A.; Kenneth Dudley Barnes; Mrs. V. A. Brixey; Arthur Brook; Stephen B. Butler, B.A.; J. H. Chapman; Cuthbert M. Checkley; Ian George Coghill; Robert Charles Coppinger,

B.SC.; Captain Rupert R. Delaval; Cpl. A. J. Fathers; Harold L. Forster; Michael J. Forster; James M. Gummery, B.A.; Geoffrey S. Hall; The Hon. R. M. C. Hill; John M. Holland; Mrs. M. A. Humphreys; John Kosky; the Rev. Neil Beresford; Cecil Plant; Kenneth Rodney Pringle; Mrs. Dorothy Rice; David John Rogers; Louis B. Tait; Chooi Hor Teoh; Alan S. Thies; E. W. Kevin Walton, D.S.C.; S. Williams; Lieutenant C. J. C. Wynne-Edwards; John Wysock-Crundall

Election to Associate Membership: R. E. Glascock; David R. Goddard; John A. R. Howell; Nigel Moffatt Owen

SESSION 1955–56

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Meeting of 31 October 1955. The President in the Chair

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Elin G. Cole; Graham W. J. Cook; Richard D. Corser
Chandrasen N. Dafal, B.A.; Flight Lieutenant John W. D
Pilot Officer Patrick F. Fathers; Robert Fielding; Mi
David J. George; Rudolph Glossop; Christopher J. Har
Meredith J. K. Houston, M.A.; J. C. Harrison; Albert C.
Jillard; Wing Commander A. N. Jones; Edwin J. Kestle;
Jaisinh H. Koregaokar; Leonard G. Leach; Miss Barbara
Dr. George W. Marsh; James E. Mansfield; Miss Elizab
Mills, B.A.; Albert M. Morse; Roger Myrsep; Robert D.
Vernon T. O'Brien; John A. Opoku, O.B.E.; John A. Opp
Pease; Sarat K. Pramanik, B.A.; John J. PreVol; Brian J.
A. O. Gofton-Salmond; Hubert C. Scholtz; Mrs. Jennifer Shaw; Ronald B. Shaw; Frank Simpson; Alan Smith; Miss Marjorie W. Stantan; Willy Stern; Ian T. Stone; William L. J. Summerfield; Douglas R. H. Tew, D.F.C., D.F.M.; Ronald E. Thurstan; Percival M. T. Tilbrook; Rev. Ed. Todd; Mrs. Joyce M. Vale; Victor W. von Hagen; Ivor G. Wellington; Edmund Wright; Dr. John K. Wright; Leonard G. P. Wycherley

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Paper: Along the Malabar Coast. By Mlle. Ella Maillart

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THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

FELLOWSHIP

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Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £2 each; *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £3 each. Thereafter the Annual

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Annual Subscription may be paid by
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Annual Subscriptions at any subsequent
each Annual Subscription paid in excess
5 payments.
or to enjoy any privilege of the Society

MEMBERSHIP

of Associate Membership provide that—
han 17 and not more than 20 years of age.
y a Fellow, University or School authority.
annum without Entrance Fee.
Associate Members become eligible for
Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.

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For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from £4 to £2. The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £1 10*s*. 0*d*. each *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £2 10*s*. 0*d*. each: thereafter payment may be by instalments as above. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order.

Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 less £2 for each Annual Subscription paid in excess of five with a minimum of £20 after 25 payments.

No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

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The Bye-Laws covering the terms of Associate Membership provide that—

1. *A candidate must be not less than 17 and not more than 20 years of age. He (or she) must be recommended by a Fellow, University or School authority.*

2. *Subscription shall be £2 per annum without Entrance Fee.*

3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

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